*** PUBLIC COMMENT DRAFT ***

PUBLIC HEALTH ASSESSMENT

DEL AMO SUPERFUND SITE

near TORRANCE, LOS ANGELES COUNTY, CALIFORNIA

CERCLIS NO. CAD029544731

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Prepared by:

California Department of Health Services
under Cooperative agreement with the
Agency for Toxic Substances and Disease Registry

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List of Abbreviations and Acronyms

ATSDR-Agency for Toxic Substances and Disease Registry
BaP-eq- Benzo(a)pyrene equivalent
bgs- below ground surface
BTEX- Benzene, Toluene, Ethylbenzene, Xylenes
CARB- California Air Resources Board
CDHS-California Department of Health Services
COCs- chemicals of concern
CREG- Cancer Risk Evaluation Guideline for one in a million excess cancer risk (ATSDR)
DAAC- Del Amo Action Committee
DHHS- U.S. Department of Health and Human Services
DTSC- California Department of Toxic Substances Control
EAPC- Exposure Area of Potential Concern
EHIB- Environmental Health Investigations Branch
EMEG- Enivornmental Media Evaluation Guide (ATSDR)
IARC- International Agency for Research on Cancer
kg- kilogram
LNAPL- light non-aqueous phase liquid
LOAEL- Lowest Observable Adverse Effect Level
MCL- Maximum Contaminant Level for drinking water (state and federal)
mg- milligram
MRL- minimal risk level (ATSDR)
NA- not analyzed or not applicable
NAPL- non-aqueous phase liquid
ND- not detected
NOAEL- no observable adverse effect level
NPL- National Priorities List (USEPA)
NS- not sampled
NTP- National Toxicology Program
OEHHA- Office of Environmental Health Hazard Assessment of the California Environmental Protection Agency
PAHs- polycyclic aromatic hydrocarbon compounds
PCBs- polychlorinated biphenyl compounds
PCE- tetrachloroethylene
PHA- public health assessment
ppm- parts per million
ppb- parts per billion
PRGs- preliminary remediation goals (USEPA)
PRP- potentially responsible party
RCRA- Resource, Conservation, and Recovery Act
REL- reference exposure level (OEHHA)
RfC- reference concentration (USEPA)
RfD- reference dose (USEPA)
RI- remedial investigation
RI/FS- remedial investigation/feasibility study
RMEG- Reference Dose Media Evaluation Guide (ATSDR)
ROD- record of decision (USEPA)
SCAQMD- South Coast Air Quality Management District
SVOC- semi-volatile organic compound
TCE- trichloroethylene
TRI-Toxic Release Inventory (USEPA)
USEPA- United States Environmental Protection Agency
VOC- volatile organic compound

Summary

The California Department of Health Services (CDHS) has prepared this public health assessment (PHA) under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). The PHA is a document that provides the community with information on the public health implications of specific hazardous waste sites and identifies those populations for which further health actions or studies are indicated.

The Del Amo site is located in western Los Angeles County, California, between the cities of Torrance and Carson. The Del Amo site covers an area of about 280 acres where a synthetic rubber manufacturing plant operated from 1942 until 1972. In 1972, the facility was sold to a development company and was subsequently dismantled. Most of the 280-acre site has been redeveloped into an industrial park. The area of the site with the majority of the contamination is called the "waste pit area". This area is currently fenced and covered with a cap. Groundwater under the former Del Amo facility and the waste pits are contaminated with chemicals from the former rubber manufacturing plant. The groundwater contamination is mixed with contamination from the nearby Montrose Superfund site, on the western edge of the Del Amo plume, and from a few smaller facilities. In this PHA, there will be separate discussions of the health hazard posed by the developed part of the site, the waste pits, the groundwater contamination, and possible off-site exposures.

CDHS and ATSDR released a preliminary PHA of the Del Amo site on January 12, 1994, the first time it was nominated to the U.S. Environmental Protection Agency's (USEPA) National Priorities List (NPL). That PHA was written when very little site investigation had taken place. In the document, CDHS and ATSDR concluded that the Del Amo site posed an indeterminate public health hazard to nearby residents and workers. A health study and a review of vital statistics and cancer registry information indicated that residents living near the Del Amo site did not appear to experience increased rates or unusual patterns of cancer or mortality. In the PHA, CDHS/ATSDR made several recommendations for additional environmental data gathering that would assist in evaluating the health hazard the site poses. Many of the recommendations that were made in the first PHA have been followed-up and this additional information was reviewed and evaluated in this PHA.

As a part of the writing of the first PHA, CDHS and ATSDR staff began working with the community. CDHS has been working with the community and other agencies on a variety of Del Amo and Montrose-related activities since 1992. In particular, ATSDR and CDHS worked closely with the Del Amo Action Committee, a group of former and current residents in the neighborhood south of the site.

In this reexamination of the site, CDHS determined that the site posed a health hazard in the past, poses a health hazard now, and is an indeterminate health hazard in the future. This conclusion is based on CDHS's evaluation of nine pathways of possible exposure related to the Del Amo site: two for the developed portion of the site, four related to the waste pits, and three specific to the neighborhood located south of the site. The following is a summary of the evaluation of each of

these pathways.

* Based on soil investigations in those exposed areas of the developed portion of the site, exposure to long-term workers, occasional workers, and children at a daycare does not present a public health hazard related to Del Amo-related contaminants. Limited surface and shallow soil sampling in the developed portion of the site indicates that there are several chemicals not definitely-related to the Del Amo site (arsenic, dichlorodiphenyltrichloroethane (DDT) and Arochlors/total polychlorinated biphenyls (PCBs)) found at levels of health concern. For the long-term worker and occasional worker, these non-site related chemicals pose an insignificant to slight increased cancer risk. The chemicals measured in the soil would not result in non-cancer health effects for long-term workers, occasional workers, or children in the daycare. Since soil testing was only conducted in the exposed areas of the site, when a building is torn down or a parking lot removed, there is the potential for contaminated soil to be exposed.

* The groundwater under and around the Del Amo site is contaminated with various chemicals arising from the Del Amo and Montrose sites as well as other nearby sites. Currently there are no domestic, irrigation, or industrial wells pulling water from the contaminated groundwater, thus no one has been exposed and no one is being exposed through the use of the water as drinking water. If the groundwater is cleaned up and contained as planned, the groundwater contamination will not spread to the drinking water wells and thus there is no concern for future exposure from using the groundwater as drinking water.

* Indoor air in buildings located on the developed portion of the site may be affected by semivolatile compounds (SVOCs) in nearby contaminated soil or groundwater. CDHS estimates of indoor air impacts from contaminated soil using modeling indicate that chemicals coming from the beneath building in areas where there is light nonaqueous phase liquid (LNAPL) may contribute to a very low increased cancer risk and a possibility though unlikely of non-cancer health effects for the long-term worker in the building. A child attending daycare could but is also unlikely to experience non-cancer health effects from these estimated levels of exposure to benzene from the LNAPL. For those buildings in the developed portion of the site where there is no LNAPL, cancer or non-cancer health impacts are not expected for the long-term worker, the occasional worker, or the child attending daycare. There are many assumptions in modeling this exposure that may influence the validity of these findings. Sampling conducted in 13 buildings on-site, including a building over the LNAPL contamination, indicate that indoor air quality is similar to typical indoor air.

* Based on available data, direct contact with the contamination in the waste pit area posed a health hazard before it was capped. Though the waste pits were covered with fill as far back as the 1950s and fenced in the 1980s, there are reports that children played at the waste pits and the waste material was seen at the surface. The waste pit material is high in polycyclic aromatic hydrocarbons (PAHs) and volatile organic compounds (VOCs), the prominent compounds are naphthalene, benzo(a)pyrene, benzene, and ethylbenzene. Limited surface soil testing over the waste pits indicate that soil would not pose a health hazard. However, if children directly handled the waste material on a frequent basis, it would have posed a health hazard to children. The

estimated exposures related to the contaminated waste pit material presented a low increased cancer risk (2.8 in 10,000) for children who played with the waste on a fairly regular basis. These children could also have experienced non-cancer health effects related to benzene exposure. The waste pits are now capped eliminating this exposure.

* Based on available data, air emissions from the contamination in the waste pit area did not pose a health hazard before it was capped. If the waste material is disturbed, VOCs (for example benzene and ethylbenzene) are released in large amounts. The undisturbed waste also emitted chemicals to the air through the fill material. However, air measurements taken around the waste pits indicate the waste pit emissions do not significantly affect the air quality in the area when undisturbed.

* The responsible parties as ordered by the USEPA capped the waste pits area in 2000. This eliminates any current or future exposure and emissions from the waste pits at the site.

* An aspect of the treatment strategy for the control of the waste pit contamination consists of a system below the waste pits to keep chemicals from moving into the groundwater. This system pulls the VOCs in the soil below the waste material to the surface. At the surface the material needs to be treated. So far the treatment strategy has not been selected by the USEPA. CDHS and ATSDR recommend that the potential health impact of the treatment strategy be evaluated before the selection is made.

* It is theoretically possible that indoor air in buildings located to the south of the Del Amo site may be affected by the contaminated groundwater flowing underneath their homes. CDHS estimates of indoor air levels indicate that the groundwater does not pose a health hazard to residents living south of the site at this time. The USEPA has sampled the indoor air of a few homes along W.204th Street and did not find there was a health threat from groundwater vapors.

* Based on soil investigations in and near the residential neighborhood south of the Del Amo site, exposure to adult and children to surface soils does not present a health risk related to Del Amo-related contaminants. The surface and shallow subsurface soil in the neighborhood did contain elevated levels of DDT and there have been several excavations to remove the DDT contamination. Arsenic and cadmium have been detected at levels exceeding typical western soils and health comparison values. Arsenic and cadmium are not related to activities at the Del Amo site. There have also been detections of other chemicals (primarily PAHs) that could be related to the Del Amo site.

* The responsible parties for the Del Amo site bought approximately 55 homes located south of the waste pits area. These homes have been removed. The responsible parties graded the property in preparation for it to become a county park. As part of the grading, the responsible parties contractors were directed by DTSC to collect the “blue lava rock-like material” that community members had seen on the property and place it at a depth of 3 to 5 feet below the surface where the basketball court is planned. This blue lava rock-like material contains elevated levels of arsenic, lead, copper and zinc. Testing of the surface soil after the grading did not find

DDT or metals at elevated levels, indicating that the surface soil does not pose a health hazard. The county's recent subsurface sampling is not relevant to human health exposure, but they also collected one surface soil sample which contained no detectable levels of pesticides and no elevated metals. Slag material gathered by the county contained some elevated metals, this material should be removed before the park is created.

CDHS has made several recommendations related to reducing or eliminating any current or future exposures. In particular, CDHS and ATSDR recommend that additional attention be paid to the indoor exposure pathway on the developed portion of the site especially in areas where LNAPL exists under a building.

Background

This PHA was prepared by CDHS under a cooperative agreement with ATSDR. In this document, CDHS and ATSDR will determine whether health effects are likely to occur because of exposure to site contaminants and will recommend actions to reduce or prevent possible adverse health effects. ATSDR, located in Atlanta, Georgia, is a federal agency within the United States Department of Health and Human Services and is authorized by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 to conduct PHAs at hazardous waste sites. The conclusions of this PHA for the Del Amo site are based on a review of available environmental data, community concerns, information obtained from site visits, and consultation with involved agencies and the public.

The USEPA first proposed the Del Amo site to the NPL in July 1991. The site was listed on the NPL in 1998, but was subsequently removed due to a lawsuit brought about by a group of Del Amo property owners. In December 2000, it was again nominated to the NPL.

Site Description And History

The Del Amo site is located in western Los Angeles County, California, between the cities of Torrance and Carson (Figure 1 in Appendix) (1). The Del Amo site covers an area of about 280 acres where a synthetic rubber manufacturing plant once operated. The U.S. Government constructed the synthetic rubber manufacturing plant in 1942 for use during world War II. From 1942 to 1955, private companies, including the Shell Oil Company, the Dow Company, and several others operated the plant for the government. In 1955, the facility was sold to Shell which operated the plant until 1972. In 1972, the facility was sold to a development company and was subsequently dismantled. Most of the 280-acre site has been redeveloped into an industrial park. The area of the site with the majority of the contamination is called the “waste pit area” (Figure 1 in Appendix C). This area is currently double fenced and covered with a cap. Groundwater under portions of the former Del Amo facility and the waste pits are contaminated with chemicals from the former rubber manufacturing plant. The groundwater contamination is mixed with contamination from the nearby Montrose Superfund site, mostly on the western edge of the Del Amo plume, and from a few smaller facilities (2). In this PHA, there will be separate discussions of the health hazard posed by the developed part of the site, the waste pits, the groundwater contamination, and off-site exposures locations/areas.

Developed portion of the site

The facility consisted of three plants (Figure 1 in Appendix C): a styrene plant, a butadiene plant, and a synthetic rubber plant. Past records regarding the manufacturing operations that occurred at the site provide an indication of some of the materials used and products and waste materials generated (1). The styrene manufacturing plant process included ethylene production; ethylbenzene was produced from benzene and ethylene; and styrene was produced from ethylbenzene. Butadiene was manufactured from a petroleum derived butylene mixture. The styrene and butadiene were piped to the rubber plant where they were copolymerized with soapy water to make synthetic rubber.

An independent company called Eston Chemical operated an ethylene dibromide facility in the southwest corner of the styrene plant area (1). The facility operated there for approximately 15 years beginning in 1947. They produced about 8,000 pounds of ethylene dibromide a day by the addition of bromine to ethylene gas. The ethylene gas was produced at the styrene plant.

An extensive system of above ground and some underground pipelines existed on site to transfer raw materials, by-products, products, and possibly waste products (1). In addition to the pipelines between the plants, some materials like benzene, propane, and butylene were transported by pipeline over 15 miles to other related facilities in nearby cities. A pipeline easement currently still runs across the southern end of the site in between the former waste disposal area and Del Amo Boulevard.

The synthetic rubber manufacturing plant was decommissioned and dismantled in the early 1970s and subsequently was redeveloped during the 1970s, 1980s, and 1990s, as a commercial and industrial park (3). Currently, virtually all the land surface within the business park is covered by buildings, parking areas and/or roadways, and landscaped areas. Of the 67 on-site parcels only two remain undeveloped.

The focus of the investigations at the site have been based on the historical uses of the land (Figure 3) (4). Historically the site was laid out such that there were multiple areas of densely packed chemical storage and processing areas separated by large areas of open space, parking or administration facilities. The responsible parties who responded to USEPA's legal request for investigation and clean-up (Shell Oil Company and Dow Company) began collecting data on the site in the early 1990s in those areas where there was known chemical storage or processing and in places where they could gain access to the land surface without disrupting the businesses currently operating there. This first phase included soil gas sampling, groundwater sampling, soil sampling, and workplace indoor air sampling. This data was summarized in the Phase I Remedial Investigation Report released in 1993 (1). Subsequent to this, additional data was gathered by the responsible parties through a series of addendum workplans.

Environmental data has also been gathered by various entities interested in developing or occupying some of the property on the site (5-21).

The following is a brief summary of the findings for the developed area of the site from all investigations:

- surface soil (less than 1 foot below ground surface (bgs)) testing show VOCs in the northwest corner; some SVOCs in the northwest corner of the plant site; DDT in the southwest corner; and arsenic and chromium above background levels in the northwest corner;
- shallow soil (1 to 15 feet bgs) is contaminated with benzene, ethylbenzene, xylenes, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene near VOC storage tanks in the styrene plant

area, in the vicinity of a former plant site laboratory and associated pipelines within the butadiene plant, and near a benzene feedstock pipeline at the southeast corner of the butadiene plant and similar contamination of DDT, arsenic, and chromium as found in the surface soil;

- shallow soil gas sampling (approximately 7 feet bgs), collected from over 900 locations in areas where chemicals were known to have been stored, transported, or processed, showed the highest concentrations to be within the former styrene plant, particularly at areas where VOC storage tanks were located, in the vicinity of a former laboratory, and along a benzene feedstock pipeline, both near the southeast corner;
- workplace air sampling in 13 buildings did not detect any VOCs present above the test-specific comparison values (the worker exposure level called the PEL divided by 20)
- twelve groundwater contamination sources areas were identified; and
- three of the groundwater contamination source areas have high enough concentrations of contamination such that the contamination is separated from the water (similar to what happens when you mix oil and water), this is called nonaqueous phase liquid (NAPL)

In the section entitled Environmental Contamination/Pathways Analysis/Public Health Implications, there will be a more in-depth discussion of this contamination and the ways that people may or may not be exposed to it.

Waste Pits

The Del Amo waste pit area comprises 5 acres on the southern end of the site (Figure 1 in Appendix C) (22). The waste pits were used for disposal of certain wastes generated at the rubber plant. The waste pits were covered with clean fill material in the late 1960s and 1970s. The thickness of the cover material ranges from 1 foot to 8 feet. Waste and contaminated soil in the disposal area contain high concentrations of chemicals primarily PAHs and VOCs. The waste pits consist of three former evaporation ponds (1A-3A) and six disposal pits (2A-2F). One of the evaporation ponds (1A) was partially excavated by the landowner in 1982. The USEPA estimates that 30,000 cubic yards of waste weighing over 34 million pounds currently exists in the former waste pit area (3).

The California Department of Toxic Substances Control (DTSC)[1] began oversight of the waste disposal pits in 1982, during the excavation activities at waste pond (22). Under DTSC's direction, groundwater monitoring, a soil gas study, and soil sampling around the waste pit area were conducted in the mid-1980s. In 1991, the DTSC turned over regulatory responsibility for the

[1]Prior to July 19, 1991, the Department of Toxic Substances Control (DTSC) was known as the Toxic Substances Control Program within the Department of Health Services. Under a reorganization, DTSC is now part of the California Environmental Protection Agency (Cal EPA).

waste pits and the rest of the site to the USEPA when the site was nominated to the NPL[2]. During the mid-1990s, Shell Oil Company and Dow Chemical Company paid for several investigations of contamination at the waste pit area as well as in the developed portion of the site and in the groundwater.

The USEPA chose the plan for dealing with the waste pit contamination in 1997. The plan called for the covering of the pits with a particular type of cap that would keep the rain water from entering the waste and for a soil vapor extraction system to capture gases from contaminated soil beneath the waste pits to keep the contaminants from moving down into the groundwater. The cap was constructed in 1999, the soil vapor extraction system was built in 2000, but has not yet been turned on because the treatment technology for the soil gas has not been chosen.

In the Environmental Contamination/Pathways Analysis/Public Health Implications section, there will be a more in-depth discussion of the waste pit contamination and the ways that people may or may not be exposed to it, including a discussion of possible exposures from the treatment technology for the soil gas.

Groundwater

The groundwater in the area around the Del Amo site is contaminated with chemicals that originated from the Del Amo site, from the Montrose site, and from a few smaller nearby facilities (Figure 4 in Appendix C) (2). Groundwater is heavily contaminated with chlorobenzene, benzene, trichloroethylene and other VOCs and SVOCs.

Groundwater is water beneath the surface of the ground. The groundwater under the Del Amo site occurs about 35 to 70 feet below the land surface (3). The groundwater is considered a resource as it may be used by people for drinking, irrigation, or industrial purposes. There is no documentation to suggest that anyone has drunk/sued or is drinking/using the contaminated groundwater.

Because the contamination could spread and threaten drinking water wells in the area in the future, the USEPA ordered the responsible parties to investigate methods to clean-up the groundwater. In 1999, the USEPA chose the method of addressing the groundwater contamination. For the upper aquifers that contain dissolved Del Amo-related contamination, natural attentuation was chosen. Natural attenuation depends on biodegradation (contaminants are broken down by microscopic organisms like bacteria that are naturally in the soil). Biodegradation of the Del Amo related contamination will result in water and carbon dioxide as breakdown products. For the lower aquifers with disolved Del Amo-related contamination and for the areas with Montrose-related contamination, the water will be cleaned up to drinking water

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[2]The NPL is a list of the top-priority sites in the country contaminated with hazardous substances and eligible for investigation and cleanup under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as the Superfund program.

standards by pumping the contaminated water to the surface and treating the water to remove the contaminants prior to injecting it back into the ground. In the area of groundwater where the contamination is high (the LNAPL areas), it is technically impractical to cleanup the groundwater to drinking water standards, therefore the contamination will be contained. In this area, it is anticipated that biodegradation of the LNAPL will occur, and again the major products will be carbon dioxide and water.

In the Environmental Contamination/Pathways Analysis/Public Health Implications section, there will be a more in-depth discussion of the groundwater contamination and how it does not currently pose a health hazard because it is not being used as a water source and how in some areas where the groundwater is highly contaminated, it poses a threat to indoor air in buildings on the site.

Off-site Investigations

Because of the concern for off-site migration of chemicals from the Del Amo site, there has been soil and soil gas sampling in the area south of the facility. Soil gas samples (samples of air within the soil) taken along Del Amo Boulevard south of the site indicate that VOC contamination is not migrating from the waste pits or the pipelines that run across the southern border of the site.

In 1993, USEPA collected soil samples in the backyards of homes located on the north side of West 204th Street between New Hampshire Avenue and Normandie (23). No chemicals related to the Del Amo site were found at levels of health concern. The sampling did, however, find the pesticide DDT (dichlorodiphenyltrichloroethane) in two yards (1051 and 1055 204th Street). The DDT-contaminated soil was thought to have been taken from the Montrose site and used as fill material when the homes were built. USEPA conducted removal action in 1994, in the two yards where the high levels of DDT were found in the soil. In 1997, the USEPA conducted further excavation activities along 204th Street for DDT-contaminated soil.

The Del Amo responsible parties purchased the property where the high levels of DDT were found, as well as 63 other properties along 204th Street. As a part of the buyout process, the responsible parties helped form a community advisory panel to determine the end land use for the buy-out area. The task force met several times and selected a community park for the future use of the buy-out area. The task force helped create a design and layout for the park. The responsible parties have paid for the grading of the property and post-grading testing was conducted for DDT and metals (24). Los Angeles County Parks and Recreation have agreed to take over the property. Funds were appropriated by the state legislature to help build the park. Additional funds will be needed to build the park as it was designed.

In the Environmental Contamination/Pathways Analysis/Public Health Implications section, there will be a more in-depth discussion of the off-site investigations for Del Amo related contaminants. The DDT-related investigations and cleanup will not be discussed in this health assessment because they are not related to activities of the Del Amo facility.

Previous Public Health Activities at the site

CDHS and ATSDR released a preliminary PHA of the Del Amo site on January 12, 1994, the first time it was nominated to the NPL (25). That PHA was written when very little site investigation had taken place. In the document, CDHS and ATSDR concluded that Del Amo site posed an indeterminate public health hazard to nearby residents and workers. A previously conducted health study and a review of vital statistics and cancer registry information indicated that residents living near the Del Amo site did not appear to experience increased rates or unusual patterns of cancer or mortality (26). In the PHA, CDHS/ATSDR made several recommendations for additional environmental data gathering that would assist in evaluating the health hazard the site poses. Many of the recommendations that were made in the PHA have been followed-up and this additional information was used in this PHA (see Appendix D for a summary of the recommendations from the first PHA and the follow-up actions that have taken place).

As a part of the writing of the first PHA, CDHS staff began working with the community. CDHS has been working with the community and other agencies on a variety of Del Amo and Montrose-related activities since that time (see Appendix E for a summary of the public health activities conducted by CDHS). The community outreach activities will be summarized in the Community Concerns section of this PHA.

Site Visits

CDHS staff have visited the neighborhood around the Del Amo site many times over the last ten years. CDHS has conducted community interviews, attended community/agency meetings in resident's homes, and observed sampling and excavation activities along 204th Street, Kenwood Avenue, and in other places in the community. Staff have also observed the waste pits from the fence line, and driven around the developed area of the site.

Demographics

Based on the 1990 census (the 2000 census data is not yet available by zip code), approximately 15,988 people live in the zip code where the Del Amo site is located (zip code 90502) (Figure 2 in Appendix C) (27). This zip code also includes the neighborhood to the south of the site. The race makeup is 57% white; 22.5% Asian or Pacific Islander; 0.4% Native American; 6% African American; and 13.6% other races. Twenty six percent are of Hispanic origin. In 1990, 22.8% of the total population was under the age of 18, and 10.4% was over the age of 65.

The Del Amo site is located in the City of Los Angeles, and the neighborhood to the south is located in an unincorporated area of Los Angeles County, between the City of Torrance and the City of Carson. Based on the 2000 census, approximately 137,946 people live in the City of Torrance (27). The race makeup is 59% white; 31.1 Asian or Pacific Islander; 2.7% African American; 1.1% American Indian, Eskimo, or Aleut; 0.8% Native Hawaiian or other Pacific Islander, and 6.3% other race. In 2000, 23% of the total population was under the age of 18, and 14.1% was over the age of 65 (27).

Land Use

The Del Amo site is zoned for light industrial and commercial use. There are 67 parcels of property within the Del Amo developed area (28). Two of these parcels are road strips (Pacific Gateway and Magellan Street). Some of the parcels have a special designation that would allow live-wrok uses (loft,etc.). Two of the parcels are utility right of ways (5342-71-46 and 5342-19-22). Of the remaining parcels, only two have not been developed.

The southern portion of the site is bounded by a portion of Del Amo Boulevard, which is currently a paved alley. To the south of this is a neighborhood consisting primarily of single-family homes, with a complex of condominiums on the eastern edge of the neighborhood along Vermont Avenue.

To the east of the site is Hamilton Avenue and commercial and industrial facilities on the east side of the street. To the east of this is a large freeway, the 110.

To the north of the site is 190th Street, on the north side of 190th Street are industrial and commercial buildings. To the north of this is a large freeway, the 405.

To the west of the site is a block wide swath of commercial and industrial buildings. To the west of this is Normandie Avenue.

In the area around the site there are numerous facilities that use hazardous chemicals and properties that have been named to the county, state, or federal governments list of hazardous waste sites (Figure 5 in Appendix C). Some of these properties include the Mobil Refinery which is located a half-mile to the east. Farmer Brothers Coffee Company, is located along Normandie Avenue. Jones Chemical is an active site. McDonnell Douglas and Montrose Chemical are closed facilities that are being cleaned up because of hazardous waste issues. The closed Gardenia Landfill #4 is located southeast of the Del Amo site. The landfill is under county oversight, and is being reviewed by the USEPA for possible listing on the NPL. Some of these nearby facilities have affected groundwater and contribute to the air quality in the area (see next section).

Toxic Release Inventory (TRI) Search

The Toxic Release Inventory (TRI) maintained by USEPA contains information on estimated annual releases of toxic chemicals from active industrial facilities from 1987 to present. TRI data can be used to get a general idea of the current environmental emissions occurring at or around a site and whether they may be causing an additional environmental burden to the community. TRI contains information on estimated annual releases (emission rates) of toxic chemicals to the environment (via air, water, soil, or underground injection), whether these releases are routine releases, spills and other accidental releases, or occasional releases from normal operation. Facilities must report their releases of toxic chemicals to TRI if they fulfill four criteria: 1) they must be a manufacturing facility; 2) they must have the equivalent of 10 full-time workers; 3) they must either manufacture or process more than 25,000 pounds (lbs) of the chemical or use more than 10,000 lbs during the year; and 4) the chemical must be on the TRI list of 350 specific toxic chemicals or chemical categories.

CDHS searched the TRI for the years 1988 to 2000 (the most recent year for which data is available) for potential emission from the area around the Del Amo site (29). CDHS conducted a TRI search for environmental releases from other companies located within the zip code (90502) surrounding the Del Amo site (Figure 2 in Appendix C). We also reviewed releases from the zip code due east of the zip code 90501 and for the zip code that includes the Mobil Refinery (90509). The TRI contained reports of releases of a total of 44 different chemicals from companies located in the vicinity of the Del Amo site (Table 1, Appendix B). TRI information indicates that in addition to the on-site contamination, there are a number of additional sources and releases of contaminants in the vicinity of the Del Amo site.

The releases summarized in Table 1 are primarily air releases (29). The predominant wind direction is from the west and southwest. The largest releases in the area are from the Mobil Refinery located in zip code 90509 (Figure 2 in Appendix C). Mobil's releases account for over 99% of the totals in that zip code. In 1999 (the last year for which TRI data is available), three facilities in the zip code (90502) where the Del Amo site is located reported releases to the TRI: Geron Furniture, Stewart Filmscreen Corporation, and R.R. Donnelly & Sons Company. Douglas Aircraft when it was in operation reported air releases greater than half a million tons per year. Douglas Aircraft ceased operation in 1992, and the releases in the zip code containing the Del Amo site dropped.

This information will not be evaluated as part in the Del Amo PHA but is presented to inform the community about other sources of chemicals in their neighborhood.

Community Health Concerns

In 1983, the community first became aware that the Del Amo site was considered to be a hazardous waste site. That year, residents organized the first of three grassroots community groups formed in the 1980s, to take action against environmental pollution in the neighborhood. In an informal survey carried out by community members, there were reports of skin rashes, numbness of the feet and hands, respiratory problems, prolonged colds, cancers of various types, miscarriages, birth defects, stomach aches and headaches (25). In response to these concerns, in 1984, the Epidemiological Studies and Surveillance Section of CDHS conducted a health study, which was released in 1987 (26). Health effects detected were those often associated with airborne pollutants, such as skin, eye, nose, and throat irritation, as well as earaches, dizziness, and fatigue. The study found that some symptoms, such as headaches, sore throats, and sinus congestion, occurred more often in people who reported odors in their neighborhood. There were numerous complaints of such odors, especially after it rained.

In 1991, as part of a preliminary PHA which was released in 1994, CDHS/ATSDR spoke with residents from ten households during a door-to-door canvas of the area near the site (25). The majority of the households complained of unpleasant odors describes as gas/burned oil/chemical smells. The health effects described were consistent with those found in the CDHS's 1984-1987 health study (26). The three predominant complaints reported in 1991 were: 1) rashes and skin irritations; 2) chronic respiratory problems, including asthma, allergies, trouble breathing, and bronchitis; and 3) headaches. Several respondents said they had problems with nausea. Seven of the households reported difficulty growing fruits and/or vegetables, with complaints of unusual shape, size, color, or taste. There were also concerns expressed about the quality of the drinking water and the health problems of pets.

Since that time, CDHS/ATSDR has had continued involvement with this community, largely in relation to the nearby Montrose Chemical Corporation Superfund site which impacts the same neighborhood. In 1993, during USEPA off-site soil sampling related to the Del Amo site, the pesticide DDT was found in residential soil on 204th Street directly across from the Del Amo waste pits (23). The DDT, which was found to be at levels of health concern, appears to have come from the Montrose site where it had been manufactured. Contaminated soil from that site had been used as fill material when the neighborhood was developed. Until that point, community health concerns had been focused only on the Del Amo site. Now the same community was also concerned about the DDT, a contaminant unrelated to the Del Amo site. Many residents now attributed their health problems to one of the two sites, and sometimes to both. A new community activist group, the Del Amo Action Committee (DAAC) was formed, and has since been instrumental in giving a greater voice to community health concerns.

In 1997, the Del Amo/Montrose Interagency-Community Partnership was formed by the DAAC organizer and the multiple agencies involved at both sites to collaborate on site-related issues. The major focus of concern regarding the Del Amo site continued to be exposure to toxic air emissions. After the waste pits were capped in 1999, there was also concern about technology that was being considered for vapor treatment. DAAC and others were against the use of any incineration technology that would produce dioxins. In response, the Partnership brought together agencies, and community and environmental groups to participate in a detailed review of several treatment technologies that might be applied. This collaboration took place over the following year and resulted in the selection of an alternative treatment technology (the alternative technology is further discussed later in the PHA). The Partnership ended in September 2001.

As part of the PHA process, in August 2001, CDHS-EHIB staffers Judy Lewis and Dr. Marilyn Underwood contacted DAAC to find out the community's current concerns regarding the Del Amo site. The DAAC Director expressed the following concerns: 1) possible health risks from the presence of vinyl chloride in groundwater beneath a group of condominiums that might co-mingle with other contaminants (The director stated that this contaminant was detected during monitoring for methane gas from the nearby Gardena Landfill #4); 2) potential health risks from the technology chosen to treat the vapors from the waste pits; 3) possible negative ramifications of using pump-and-treat technology to clean up groundwater contamination; 4) the possibility that a drinking water well has been or may be contaminated; 5) the possibility that the former Eston Chemical Company may have been involved in defense research using biological agents and radioactive materials that have not been included in environmental sampling; 6) the fact that unusual storm water or rain events have not been taken into account when assessing potential off-site impacts on an area in a flood plain; and 7) the limited life-span of the cap that covers the waste pits. Overall, the director is concerned that the Del Amo site has not been sufficiently characterized and thinks more sampling is needed. She suggested that there were many concerns and that CDHS should hold a public meeting to inform new residents of past activities at the Del Amo site.

As part of the process of gathering community concerns, CDHS held a public availability session on September 19, 2001. The session was held at the Harbor City/Harbor Gateway Chamber of Commerce, located within the industrial park/business center developed on the site of the former Del Amo facility. A flyer in Spanish and English was mailed to 2,600 nearby residents and 500 businesses, and an announcement was placed in the local newspaper. The session was also publicized by DAAC and a notice was sent to the members of the Del Amo/Montrose Partnership. Five residents attended the session and four residents responded by phone. Two other concerned residents and three business representatives were contacted by phone as a result of a referral from USEPA. The lack of greater response may be attributed, in part, to the timing of this event, which took place just 8 days after the attackf of the World Trade Center and the Pentagon. Heightened concern at this time among some residents in the neighborhood concerning issues related to the Montrose site may also have been a factor.

Residents with concerns were equally divided between those who were new to the neighborhood and long-time residents. Two new homeowners and a new renter in the area had not been aware of the site and called to obtain information. Another renter had recently moved to an apartment across the street from the former Montrose facility. He had been unaware of either of these sites or of the other former manufacturing sites in the area where remediation of hazardous materials has occurred. He was upset that he had not been notified by his landlord. He also complained of noise and odors related to a neighboring manufacturing facility, and of poor quality drinking water. Another person who had bought a home several years ago was also concerned about the lack of full disclosure, especially because he had done extensive landscaping and had come into contact with soil. A Spanish-speaking resident new to the neighborhood said that she asked her neighbors about the site when she received the flyer, and none of them knew anything about it. She said that a neighbor's carrots were "all crooked" and did not seem normal.

The concerns of residents who had lived in the area for long periods of time were quite different. Some of these residents attributed their own or their family members' health conditions to either the Del Amo or Montrose site, in some cases not knowing which site may have been involved. Among the health conditions reported were cervical cancer, multiple sclerosis, possible skin cancer, brain and bladder masses, a large abdominal growth or hernia, and two miscarriages. One man who grew up about 1 ½ miles from the Del Amo site had both Hodgkin's lymphoma and bone cancer during adolescence, and called to inquire whether there was a known relationship between his cancers and the contaminants from this site. One resident's son had often played near the waste pits as a child, coming home covered with mud. She thought his subsequent serious health problems, including juvenile diabetes and hepatitis, might have been related to childhood exposures to toxic chemicals. Her three children who did not play in that area have not had health problems. There are other reports of children playing in fields near the waste pits before a fence was put up. When it rained, the fields would be filled with puddles where children would catch polliwogs and play. Two brothers and their friends played there as children, and wonder whether they may have been exposed to toxic chemicals that could affect their health. Possible toxic runoff from the waste pits was also a concern of a resident who had owned several properties on 204^{th}

Street since the 1960s. Before the storm drain was put in, backyards would flood and water would drain into two vacant lots at the corner of 204^{th} and Catalina where there was a low spot in the ground.

Businesses located within the Del Amo site area, now known as the Harbor Gateway Business Center, have had a different set of concerns. In one case, workers were very worried about their safety when the company moved to a building in the area. To allay worker fears, the company undertook a yearly air sampling program in and around the building. Results of the sampling have not shown problems with air quality thus far, and the workers have apparently been satisfied. In another case, a hotel in the area had problems when it first opened, because a small number of potential customers thought it was unsafe to stay there or to drink the water. Over the years this perception has diminished and has ceased to be a problem. In the past, certain businesses were hesitant to locate to the area for fear that they might be held liable for employee health problems attributed to the site. This was resolved when the property owners took responsibility for any such liability. More recently, the Harbor City/Harbor Gateway Chamber of Commerce administrative staff expressed concern that the listing of the Del Amo site on the NPL might cause problems for existing businesses and discourage new businesses from moving in. The administrative staff person was especially concerned that people would perceive a danger where there is none, and that this might slow economic development of the area. In addition, the administrative staff person views a healthy local economy as a key factor impacting the social welfare and quality of life of the surrounding neighborhoods.

Environmental Contamination/Pathways Analysis/Public Health Implications

Summary: This section examines the pathways for exposure to contamination from the waste pits, developed area, groundwater and off-site areas from the Del Amo site. CDHS will examine each of the media (soil, soil gas, indoor air, groundwater) to determine whether or not contamination is present and if people in the community are exposed to (or in contact with) the contamination. If people are exposed to contamination in any of the media, we will evaluate whether there is enough contamination to pose a hazard to people in the community. This analysis will systematically evaluate each of the media. Table 2 in Appendix B presents a summary of the exposure situations identified at this site.

Exposure only occurs when a chemical comes into contact with people and enters the body. For a chemical to pose a human health risk, a completed exposure pathway must exist. A completed exposure pathway consists of five elements: 1) a source and mechanism of chemical release to the environment; 2) a contaminated environmental medium (air, soil, or water); 3) a point where someone contacts the contaminated medium (known as the exposure point); 4) an exposure route, such as inhalation, dermal absorption, or ingestion; and 5) the person or people exposed. Exposure pathways are classified as either completed, potential, or eliminated. In completed exposure pathways, all five elements exist. Potential exposure pathways are either: 1) not currently complete, but could become complete in the future, or 2) are indeterminate due to lack of information. Pathways are eliminated from further assessment if one or more elements are missing and are never likely to exist.

A time frame given for each pathway indicates whether the exposure occurred in the past, is occurring, or is likely to occur in the future. For example, a completed pathway with only a past time frame indicates that exposure did occur in the past, but exposure is not occurring now and is not likely to occur in the future.

To screen the contaminants for evaluation, CDHS compared contaminant concentrations to health comparison values. Health comparison values are media-specific contaminant concentrations used to screen contaminants for further evaluation. Non-cancer health comparison values are called environmental media evaluation guides (EMEGs) or reference dose media evaluation guides (RMEGs) and are respectively based on ATSDR's minimal risk levels (MRLs) or USEPA's reference doses (RfDs) (see Appendix A for a glossary containing these terms(30). Cancer risk evaluation guides (CREGs) are based on the State of California or USEPA's chemical specific cancer slope factors and estimated excess lifetime cancer risk of one-in-one million persons exposed for a lifetime.

These comparison values allow an investigator to quickly sort the contaminants into groups that are either not likely to cause health effects, or contaminants that should be evaluated further. Contaminants that receive further evaluation exist at concentrations that exceed the comparison values, and are called "contaminants of concern". Exceeding a health comparison value does not imply that a contaminant represents a public health threat, but suggests that the contaminant warrants further consideration.

When there are contaminants of concern identified in a media, then CDHS will evaluate the pathway by which people are being exposed to the contaminants. In order to determine whether adverse health effects are possible as a result of exposure to a contaminant, an exposure dose must be estimated for each pathway. This exposure dose can then be compared with appropriate toxicity values in order to evaluate the likelihood of adverse health effects occurring. Toxicity values used to evaluate non-cancer adverse health effects include ATSDR's Minimal Risk Levels (MRLs) and USEPA's Reference Doses (RfDs) for ingestion and Reference Concentrations (RfCs) for inhalation (30). The MRL and RfD values are estimates of daily human exposure to a contaminant below which non-cancer, adverse health effects are unlikely to occur. See Appendix A for additional information about health comparison values.

The National Toxicology Program (NTP), the International Agency for Research on Cancer (IARC), and USEPA have reviewed available information from human and/or animal studies to determine whether certain chemicals are likely to cause cancer in humans (30). The potential for cancer to occur in an individual or a population is evaluated by estimating the probability of an individual developing cancer over a lifetime as the result of exposure. USEPA has developed cancer slope factor values for many carcinogens. A cancer slope factor is an estimate of a chemical's potential for causing cancer.

CDHS evaluated ten pathways of possible exposure related to the Del Amo site: three for the developed portion of the site, four related to the waste pits, and three specific to the neighborhood located south of the site. In the following pages, we describe our evaluation of these pathways. A brief summary of the toxicological characteristics of the chemicals that CDHS evaluated is contained in Appendix F.

Data in this section are presented in tables located in Appendix B. Figures used in this section are presented Appendix C.

Surface Soil or Near Surface Soil Exposure in the Developed Portion of the Site

Summary: Based on soil investigations in those exposed areas of the developed portion of the site, exposure to long-term workers, occasional workers, and children at a daycare program does not present a public health hazard related to Del Amo-related contaminants. Limited surface and shallow soil sampling in the developed portion of the site indicates that there are several chemicals not related to the Del Amo site (arsenic, DDT and Arochlors/total polychlorinated biphenyls (PCBs)) found at levels of health concern. For the long-term worker and occasional worker, these non-site related chemicals pose an insignificant to slight increased cancer risk. The chemicals measured in the soil would not result in non-cancer health effects for long-term workers, occasional workers, or children at a daycare program. Since soil testing was only conducted in the exposed areas of the site, when a building is torn down or a parking lot removed, there is the potential for contaminated soil to be exposed.

Most of the developed portion of the Del Amo site is covered with buildings or paved over, thereby limiting direct exposure to any contamination in the soil. There are certain areas where the soil is more accessible, and it is possible that on-site workers, utility or construction workers or occasional visitors could access the surface or subsurface soil. CDHS is not aware of any daycare programs operating on the developed portion of the site, but there is a possibility that such programs may exist. Therefore we evaluated exposure to children attending a daycare program.

Soil data gathered by the Del Amo responsible parties or other interested parties confirm that there is surface (less than 1 foot) and near surface soil contamination remaining within the developed area. Though the buildings, tanks, and associated pipelines from the synthetic rubber facility were removed, no cleanup of the soil in the developed portion of the site has ever occurred. Thus, there could be chemicals in the soil where no testing has yet occurred (e.g. underneath certain buildings and paved areas). Future development activities that require excavation, building removal or grading on the Del Amo site could expose subsurface contamination and potentially release volatile chemicals in the soil into the working environment. Therefore, there is potential for future exposure to soil contamination if excavation activities occur at the Del Amo site without safety and engineering controls.

There has been limited surface and near surface soil sampling of the developed portion of the site. This is primarily due to the fact that a large part of the site is covered with buildings or parking lots, limiting access to the soil. When soil sampling has occurred, the samples have been taken in exposed areas and in areas where there seemed to be discoloration of the surface as viewed on aerial photos or visually by the samplers (4). Soil gas sampling was the main focus as opposed to soil sampling for the site characterization as many of the chemicals associated with the Del Amo site would be found in the soil gas. Each parcel of land was not sampled equally.

CDHS staff have reviewed the data that was gathered on each parcel and summarized this information in Table 3 (28). For each parcel, we also indicate the types of activities that may have occurred in those areas. As can be seen from this lengthy table, the amount of data gathered on a particular parcel varies widely from those parcels where nothing has been gathered to those parcels where many soil, soil gas, and indoor air data was gathered. Typically, those parcels where historical activity might have resulted in contamination received most of the attention. The following paragraphs are a summary of the surface and subsurface soil sampling that has occurred in the developed portion of the site.

During the remedial investigation phase, the responsible parties collected 12 composite (a mixture of distinct or discrete samples) surface soil (0 - 6 inches from the surface) from 51 locations (28). The composite surface samples were focused on three specific areas within the site where unpaved area was present at the time of the sampling (1994-1996). Three discrete surface samples were collected in the northwest corner of the facility. The samples were analyzed for pesticides/PCBs, SVOCs, and metals (the locations of the sample locations for which SVOCs were taken are shown in Figure 8). As seen in Table 4, only a few chemicals (arsenic and DDT in several samples and total PCBs and benzo(a)pyrene in one sample) were detected at levels of health concern in the surface soil.

The responsible parties also collected shallow (greater than 6 inches to 15 feet) soil samples as part of the remedial investigation (Figure 9) (28). The responsible parties dug 31 soil borings around the developed portion of the site, samples were collected at 1 to 3 depths from each boring. Most of the samples were analyzed for benzene, ethylbenzene, toluene, and xylenes (BTEX) and for SVOCs. Some of the samples were analyzed for the whole suite of VOCs. Only eight (four of these were composites of three samples) samples were analyzed for pesticides/PCBs and eleven (four of these were composites of three samples) were analyzed for metals.

Shallow soil (greater than 6 inches to 15 feet) data has also been gathered outside of the remedial investigation efforts (28). In the two parcels located east of the waste pits there have been several investigations conducted. Except for one sample that was analyzed for SVOCs, the other 17 samples were only analyzed for BTEX. Independent site investigations in the far northwest corner of the property have resulted in 13 samples analyzed for VOCs, three samples for SVOCs, 14 samples for pesticides/PCBs, and 15 samples for metals. As seen in Table 4, a number of chemicals were detected at levels of health concern in the near surface soil. The primary chemicals of concern are arsenic, DDT, Arochlor 1260, benzene, and ethylbenzene. Several chemicals were found but not consistently at levels above health comparison values: cadmium, Arochlor 1260, total PCBs, benzo(a)anthracene, benzo(a)pyrene, N-nitrosodiphenylamine, 1,2,4-trimethylbenzene, styrene, and sec-butylbenzene.

Most of the chemicals found at levels of health concern in the soil are related to activities at the Del Amo site. The exceptions are described in the following paragraphs.

DDT is found at elevated levels in the southwest area of the site, close to the Montrose site.

Arochlor 1260 and total PCBs have been found in several samples taken in the parcel on the northwest portion of the property. These chemicals are not considered related to the Del Amo site but to some other activities that occurred on the site in recent times.

Arsenic is not considered a contaminant related to the Del Amo site. Levels of arsenic are naturally found at higher levels in western soils, and most western soils have concentrations of arsenic that exceed the health comparison value (31). Most of the soil samples taken on the developed portion of the site contain arsenic at levels typical for western soil. A few samples contained levels above typical western soil levels.

CDHS staff estimated the exposure to the surface soil in the developed portion of the site to three groups of people: long-term workers who come into contact with the soil, e.g. a gardener; an occasional worker to the developed portion who engages in digging a trench or something similar once a year; and a child who attend a day-care facility on the site and plays outside in the exposed areas of the soil (Table 5). For each group of people, CDHS staff estimated an exposure for a person exposed to the average soil level and to the maximum soil level (the assumptions used in the calculations are described below Table 5). Though it is unlikely that an individual would be exposed to the maximum soil level, we calculated this as an upper end risk. The evaluation of health impact for each population exposed to soil is described below:

- ♦ The cancer risk to the long-term worker who is exposed to the maximally-contaminated surface soil on a daily basis when at work is 4.4 in 100,000. This is considered a very low increased cancer risk. The cancer risk to the long-term worker who is exposed to the average-contaminated surface soil on a daily basis when at work is 7.6 in 1,000,000, this is considered an insignificant increased cancer risk. About 85% of the cancer risk is due to arsenic and total PCBs. None of the estimated exposures exceed the non-cancer health comparison values, indicating that non-cancer health effects would not be expected for the long-term worker if they are exposed to the maximum or average contaminated surface soil.

- ♦ The cancer risk to the worker who is occasionally exposed to the maximally-contaminated surface soil is 2.8 in 1,000,000, this is considered an insignificant increased cancer risk. The cancer risk to the worker who is occasionally exposed to the average-contaminated surface soil on a daily basis when at work is 6.4 in 10,000,000, this is considered an insignificant increased cancer risk. Arsenic and benzene contribute the most to the cancer risk. None of the estimated exposures exceed the non-cancer health comparison values, indicating that non-cancer health effects would not be expected for the worker who occasionally is exposed to the maximum or average contaminated shallow soil.

♦ It is not scientifically valid to calculate an increased cancer rate for exposure of a short time period such as 6 years as would occur for a child attending daycare on the developed portion of the site. Therefore, we only looked at non-cancer health impacts to the children. None of the estimated doses for the average soil levels exceed the corresponding health comparison values. Therefore, non-cancer health effects would not be expected for a child spending time in the soil with average contamination. For the maximally-contaminated soil, most of the chemicals did not exceed their health comparison value, indicating that non-cancer health effects would not be expected. However, the estimated exposure from the maximum level of arsenic (0.000497 mg/kg/day) exceeds its health comparison value (0.0003 mg/kg/day). The health comparison value (chronic MRL) for arsenic is based on the appearance of dermal effects (Blackfoot Disease, hyperkeratosis and hyperpigmentation) in people who drank water containing high levels of arsenic. The dermal effects were seen in people getting 0.014 mg/kg/day arsenic. There was no effect seen in those people ingesting 0.0008 mg/kg/day. Thus, though the estimated arsenic exposure exceeds the health comparison value, the dose is well below the dose at which dermal effects were seen. Thus it is not likely that health effects would be seen in children.

Arsenic appears to be the major contaminant of concern in the surface soil. For instance, a large portion of the increased cancer risk for the long-term worker and the occasional worker is due to arsenic. For children at daycare, it is not likely that they would experience any non-cancer health effects from playing outside due to any of the chemical levels measured in the surface soil though the estimated exposure from the maximally-contaminated level of arsenic exceeds it health comparison value. Arsenic levels in the western U.S. soil are typically higher than other places, and these "typical" levels could be considered above a level of health concern (31). The levels in the surface soils on the developed portion of the site reflect elevated levels in the western U.S. In addition, no processes, byproducts or waste from the former synthetic rubber plant involve arsenic.

The main chemicals that were used in making synthetic rubber are benzene, ethyl benzene, and styrene. These and other VOCs are the contaminants of main concern in the groundwater and subsurface soil. These chemicals would not typically be found in surface soils because if they once contaminated the surface soil they would tend to evaporate and thus not be present years after the manufacturing process stopped. Thus, it is not surprising that the surface soil does not currently pose a health hazard.

If pavement or a building is removed or constructed, it is possible that chemicals may be present in the surface and shallow soil which could then pose a health hazard. Thus, we would recommend further testing in those areas where soil has not been tested when and if the soil is exposed.

Exposure to the Contaminated Groundwater if it Were to be Used as Drinking Water

Summary: The groundwater under and around the Del Amo site is contaminated with various chemicals arising from the Del Amo and Montrose sites as well as other nearby sites. Currently there are no domestic, irrigation, or industrial wells pulling water from the contaminated groundwater, thus no one has been exposed and no one is being exposed through the use of the water as drinking water. If the groundwater is cleaned up and contained as planned, the groundwater contamination will not spread to the drinking water wells and thus there is no concern for future exposure from using the groundwater as drinking water.

The ground water beneath the site is found in a number of water-bearing zones (aquifers) (2). Sand and gravel form the water-bearing zones (aquifers), and silts and clay act as confining layers (aquitards) to restrict movement between the aquifers. Starting from the ground surface going downward these aquifers are named: the Middle Bellflower, the Gage, Lynwood, and the Silverado. Over time, chemicals tend to move deeper into the water-bearing zones. The Middle Bellflower and the Gage aquifers are contaminated with chemicals from the Del Amo and Montrose sites. Some of the contamination has spread to the Lynwood aquifer. For instance, benzene has been detected in one Lynwood aquifer monitoring well and chlorobenzene, a contaminant from the Montrose site, has been detected in a different well monitoring the Lynwood aquifer. The contamination has not reached the Silverado aquifer.

As the chemicals move downward in the water tables, they also move away from the source of the contamination in the direction that the groundwater flows. Groundwater flows in the south southeastern direction. As shown in Figure 4, the contaminated groundwater from the Del Amo site (using benzene as the marker) extends from the Del Amo boundary 1,500 feet south. As shown in Figure 6, the contaminated groundwater from the Montrose site (using chlorobenzene as the marker) extends from the Montrose boundary 4,200 feet to the south.
Groundwater in the area has been monitored since 1988 (2). In addition to benzene and chlorobenzene, other VOCs, SVOCs, metals, and para-chlorobenzene sulfonic acid are contaminating the groundwater. In Table 6, we present a summary of the groundwater contamination in the various aquifers. The highest concentration of the chemicals are typically found in water from on-site (Del Amo and Montrose) monitoring wells. In particular, there are five areas of groundwater contamination on the Del Amo site where the concentrations of benzene are so high that the material is no longer dissolved in the water, it has formed a separate layer. This layer is called light non-aqueous phase liquid (LNAPL). This is similar to a situation where you add oil to water. A little bit of oil will dissolve in water but at higher concentrations the oil no longer dissolves but forms its own separate layer. In the case of benzene, the separate layer floats on the top of the groundwater. the The LNAPL contamination is associated with the Bellflower zone, the upper aquifer.

The nearest municipal water well is located about 1.5 miles from the Del Amo site (3). Three water purveyors operate 14 drinking water wells within 4 miles of the site: California Water

Service Company (Dominguez District), Southern California Water Company (Southwest District), and the City of Torrance Water Department. The municipal drinking water wells in the area primarily pull from the Silverado aquifer, and this aquifer has not yet been affected by the contamination at the Del Amo and Montrose sites. In addition to the municipal wells in the area, there are industrial, irrigation, and domestic wells. Some of these pull from the Gage aquifer (2). It is possible if the contaminated groundwater from the Del Amo and Montrose sites is not treated, it could continue to move laterally outward and vertically downward and someday affect municipal and other types of water wells in the area.

In April 1999, the USEPA chose the plan to treat the groundwater contamination. The plan calls for natural attenuation and pumping the contaminated groundwater to the surface and treating it to remove the contaminants prior to reinjecting the water back into the ground or discharging into the Dominguez Channel. The contaminants will be removed to the extent that the water will meet drinking water standards. The treatment technology for extracted water has not yet been chosen. In the area where there is LNAPL and thus it is not technically possible to clean the groundwater to drinking water standards, the USEPA chose to contain the contamination by using a pump and treatment system and biodegradation. Biodegradation involves the breakdown of contaminants by microscopic organisms (such as bacteria) already in the ground. These bacteria degrade the contaminants by consuming them as food. Once implemented, the USEPA estimates that it will take 50 years or more to completely remove all the contamination outside the LNAPL areas. However, a large portion of the contamination will be removed in the first 15-25 years of the groundwater treatment system. Implementation of this clean-up plan will ensure that drinking water in the area will not be affected in the future.

The responsible parties are currently in the design phase of the remediation system. It is anticipated that the design phase may be completed by August 2003, and implementation of the plan a year from that (personal communication, DTSC project manager August 5, 2002).

As stated previously, the municipal wells have not been affected by the contamination from the Del Amo and Montrose sites because the contamination has not spread deep enough and wide enough to affect these drinking water wells. However, there is a mechanism in place to ensure that water served to the public is not contaminated by the Del Amo, Montrose, or any other source. That is, water purveyors test the water for chemicals on a regular basis to ensure that drinking water meets drinking water standards set by the state and the federal government. The drinking water supplies in this area of Los Angeles County are monitored periodically for non-volatile synthetic organic chemicals, inorganic chemicals such as metals and radiological parameters (Table 7). As indicated in Table 7, most of the chemicals found in the groundwater around the Del Amo and Montrose sites are monitored as a part of the on-going drinking water monitoring program. CDHS staff have reviewed the Drinking Water Sources Contaminant Levels System Reports for the three municipal water systems and has communicated with a representative with CDHS Drinking Water and Environmental Health Division concerning the safety of the drinking water. There have been detections of trichloroethylene in two wells in the California Water Service Company's Dominquez District and tetrachloroethylene in one well of the Southern California Water Company's Southwest District. Once detected these wells have no longer been used. Based on the distance and the location (upgradient and cross-gradient), the detection of these chemicals is not related to the plumes located around the Del Amo and Montrose sites.

During August and September 1994, USEPA in conjunction with Dominguez Water Company (now the California Water Service Company (Dominguez District) collected tap water samples from twenty-five properties located along West 204th Street (32). The tap water samples were analyzed for pesticides, SVOCs, and VOCs. Low levels of VOCs were found in all the samples. The VOCs that were measured are typically found in water supplies that are being treated with chlorine for disinfection of microbial organisms. All of these VOC levels were below state and federal drinking water standards or levels of health concern.

Indoor Air Exposure in the Developed Portion of the Site

Summary: Indoor air in buildings located on the developed portion of the site may be affected by VOCs in nearby contaminated soil or groundwater. CDHS estimates of indoor air impacts from contaminated soil using modeling indicate that chemicals coming from beneath the building in areas where there is LNAPL may contribute to a very low increased cancer risk and a possibility though unlikely of non-cancer health effects for the long-term worker in the building. A child attending daycare could but is also unlikely to experience non-cancer health effects from these estimated levels of exposure to benzene from the LNAPL. For those buildings in the developed portion of the site where there is no LNAPL, cancer or non-cancer health impacts are not expected for the long-term worker, the occasional worker, or the child attending daycare. There are many assumptions in modeling this exposure that may influence the validity of these findings. Sampling conducted in 13 buildings on-site, including a building over the LNAPL contamination, indicate that indoor air quality is similar to typical indoor air.

Several buildings presently located in the developed portion of the site are built over areas where there is known soil and groundwater contamination. The volatile chemicals in the soil and groundwater can move through the soil into buildings affecting the indoor air quality (33). This happens when the contamination is in close enough proximity to the building that the negative pressure within the building can in a sense “pull” the chemicals into the structure. Indoor air quality is also influenced by the off-gassing of volatile organic chemicals found in furniture, carpet, and other material used within the building and by the outdoor air. Taking indoor air samples will help in understanding whether the levels in the indoor air, regardless of their source, pose a health hazard. However, if you take samples of indoor air, you are probably not going to be able to evaluate whether the soil or groundwater contamination is affecting the indoor air. In this case, we evaluated the impact of soil or groundwater contamination on indoor air in the developed portion of the site using computer modeling (34). Modeling is a mathematical approach to estimating what might be happening in the environment.

As discussed previously, soil contamination data gathered from the developed portion of the site indicates that there are chemicals present in the soil that may be pulled into a structure. (Table 3 and 4, and see a previous section for description of the contamination).

Soil gas sampling has also been used to document chemical contamination in the soil (4). Specifically, the responsible parties and USEPA identified eleven source areas for contamination in the developed (not including the waste pit area) portion of site (Figure 3) (3). The responsible parties sampled the soil gas in those “exposure areas of potential concern (EOPCs)” where there was accessibility to the soil surface. The responsible parties did not sample under or near the buildings, the best type of data to use for estimating exposure to the indoor air. Soil gas data was also gathered by interested parties and developers of certain parcels of land.

Soil gas data gathered from the developed portion of the site indicates that there are chemicals present in the soil that may be pulled into a structure (Table 8 and Figure 10). Compared to soil data where there has not been extensive sampling over the site, the responsible parties collected over 900 soil gas samples. The soil gas samples were collected in places around the site where VOCs were stored, transported, or disposed. As indicated in Table 8, benzene, toluene, ethylbenzene, and the xylenes were detected in many soil gas samples. To a lesser extent, but still highly prevalent, many chlorinated solvents like tetrachloroethylene, trichloroethylene, and 1,1,1-trichloroethane were also detected. Other VOCs related to Del Amo activities were also detected in many soil gas samples: 1,2,4-trimethylbenzene, 4-ethyltoluene, cyclohexane, and styrene.

As described in a previous section, a contaminated groundwater plume exists under a large part of the developed portion of the site. In some places the contamination is so great that there is a layer of contamination that has separated from the water, this is termed light non-aqueous phase liquid (LNAPL) (2). The LNAPL is primarily composed of benzene.

To evaluate the impact of contaminated soil on indoor air, CDHS staff conducted modeling. We evaluated indoor air exposure for the long-term worker, the occasional worker, and the child attending day-care for three different buildings from an area where a relatively large amount of subsurface contamination exists to an area where very little subsurface contamination exists. We used the Johnson and Ettinger soil gas advance model, as recommended by USEPA, to estimate the amount and risk from soil gas that would move from the soil contamination beneath the structure into the structure (35). We also used the NAPL screen or advance model for estimated risk for indoor air for people in those buildings where LNAPL exists under the building. (36, 37).

The first situation that we evaluated relates to the LNAPL area that is located on the western side of the Del Amo site in Tract 7351-34-57 in the northwest corner of the former styrene plant (Figure 3). The second situation we examined was Tracts 7351-34-15, 50, 56 where the building is not located directly over LNAPL (it is located nearby), and the groundwater and soil under and near the building is contaminated. The third situation that we examined was Tract 7351-31-18 in the former copolymer area. Soil and soil gas sampling have shown contamination exists in the area; however the USEPA does not consider it to be a groundwater source area. These three situations were chosen as they represent the range of possible impacts that the contamination could have upon indoor air.

The results of the toxicological evaluation for indoor air exposure are shown in Table 10. The exposure parameters and assumptions used in evaluation are discussed below the table. The estimated indoor air concentrations for chemicals modeled in the non-LNAPL areas do not exceed the non-cancer health comparison values, indicating that non-cancer health effects would not be expected for the long-term worker, the short-term worker, or the child attending daycare for these two building situations.

For the building located over the LNAPL (Tract 7351-34-57), the estimated indoor air concentration for benzene (adjusted for time spent in the building and differences in respiration rate and body size) exceeds the health comparison value (intermediate MRL= 4 parts per billion (ppb)) for the child at a daycare (4.41 ppb) but not for the long-term worker (2.34 ppb) and an occasional worker (0.13 ppb). The intermediate MRL (exposure from 15 to 365 days) is based on an animal study where mice were exposed to benzene for 2 hours per day, 6 days per week, for 30 days (38). At 780 ppb there was an increase in the mouse's rapid response, i.e., a change in the function of the neurological system of the mouse. At that same exposure level there was an increase in grip strength, but no changes noted in several other areas: immune system measurements, body, liver or kidney weight, or blood or brain nerve enzyme. The effect level of 780 ppb was adjusted for exposure duration and 90 fold uncertainty factor applied to arrive at an intermediate MRL of 4 ppb. Even though the level of benzene modeled for the child attending daycare exceeds the intermediate MRL they are much smaller than the level at which a effect was seen (780 ppb). This indicates that non-cancer health effects like changes in neurological function are not very likely based on the level of exposure that we estimated from the modeling.

The increased cancer risk for the long-term worker who works in the building over the LNAPL () for 25 years is 1.7 in 100,000, this is considered a very low apparent increased cancer risk. For the short-term worker in the same building or for the long-term and short-term workers in the other two buildings there is an even lower estimated increased cancer risk (Table 10).

Based on the modeling of two buildings not located over LNAPL, it appears that the contamination remaining will not significantly affect the health of the workers and other people that may go into the buildings in those areas where there is no LNAPL found underneath or near the building. Based on the modeling of one building situated over LNAPL, the modeling predicts that the contamination may contribute to the overall quality of the indoor air and the health of the individuals spending longer periods of time in those buildings (long-term workers and children in day-care).

There are many assumptions used in the modeling of this pathway that could affect the validity of these results. One important factor is the adequacy of the sampling data. CDHS staff used soil gas data from sampling locations that appeared to have been drawn close to the foundation of the building. If the sampling locations that we chose to use for the modeling were in fact not within the influence of the building structure, then the soil gas data are not useful for the model and would tend to under estimate the indoor air impact. Ideally soil gas sampling should be conducted at a diagonal from the edge of the building or at the very edge of the building straight down.

On the other hand, the modeling approach that CDHS staff used does not account for possible degradation (breakdown) of compounds in the soil. In the case of compounds like benzene, ethylbenzene, toluene, and xylenes, biodegradation can play an important role and thus decrease the estimated impact from our modeling (39).

To further evaluate the indoor air pathway, CDHS reviewed the indoor air data that has been gathered onsite. Private parties have conducted indoor air sampling (40); however, we concentrated on the data gathered with oversight by USEPA. Namely, the responsible parties conducted indoor air testing as a part of the site characterization (4). In 1996, contractors for the responsible parties sampled the workplace air at twelve buildings in the developed portion of the site (Table 9) (4). Benzene, ethyl benzene, styrene, toluene, 1,1,1-trichloroethane, and xylenes were detected in most of the building samples at levels that are fairly typical for indoor air (41, 42). These chemicals have been found in the soil, soil gas, and groundwater on the site, thus there could be some contribution from the contamination.

The indoor air study conducted by the responsible parties, was designed to measure chemicals in indoor and outdoor air and compare to typical concentration ranges. The study was not designed to assess the soil gas migration pathway. Thus, one can only infer what role the soil gas pathway may play.

Two (Tract 7351-34-15,50,56 and Tract 7351-34-57) of the three buildings for which we estimated indoor air using modeling were sampled as a part of the indoor air sampling effort. For some of the chemicals (benzene, xylenes, toluene, and 1,1,1-trichloroethane in Tract 7351-34-57), the estimates from our modeling would contribute a small portion of the total amount of these chemicals measured in the indoor air. It could be that products used in the buildings or activities occurring in the buildings are the largest contributor to the indoor air. For several other chemicals (benzene, ethylbenzene, styrene, cyclohexane, PCE, and TCE in Tract 7351-34-57 and benzene in Tract 7351-34-15,50,56) our modeled concentrations would appear to be the primary contributor to the amount of these chemicals measured in the indoor air. However, the levels measured in the indoor air sampling are typical of indoor air, thus if the contamination is affecting indoor air quality it does not appear to play such a large role that the overall quality of the air is affected above typical ranges.

Exposure to the Waste Material and Surface Soil Around the Waste Pit Area Before It Was Capped

Summary: Based on available data, direct contact with the contamination in the waste pit area posed a health hazard before it was capped. Though the waste pits were covered with fill as far back as the 1950s and fenced in the 1980s, there are reports that children played at the waste pits and the waste material was seen at the surface. The waste pit material is high in PAHs and VOCs. The prominent compounds are naphthalene, benzo(a)pyrene, benzene, and ethylbenzene. Limited surface soil testing over the waste pits indicate that the soil would not pose a health hazard. However, frequent, almost daily, playing with the waste material posed a health hazard to children. The estimated exposures related to the contaminated waste pit material presented a low increased cancer risk (2.8 in 10,000) and non-cancer health effects related to benzene exposure to children who played with the waste on a fairly regular basis. The waste pits are now capped *eliminating this exposure.*

The waste pits consist of three former evaporation ponds (1A, 1B & 1C) and six disposal pits (2A-2F) (22). The disposal pits came into existence sometime between 1941 and 1947. By 1951, aerial photos show the disposal pits (2A-2F) to be covered with fill material. Though still covered in the years after this, later aerial photos show staining around the disposal pits, perhaps indicating material that had become uncovered or where the fill material had become saturated from the contamination below it. The disposal pits extend down 20 to 30 feet below the surface. The surface soil ranges in thickness from 1 foot over pit 2A to 8 feet over pit 2F. The waste material in the disposal pits has been described as black clay-like sludge or black tar. The waste material is high in PAHs and VOCs. Naphthalene and benzo(a) pyrene are the dominant PAHs in the waste, while benzene and ethylbenzene are the dominant VOCs. For example, the waste in disposal pit 1A had a waste sample that contained 7,900 parts per million (ppm) benzene, 1,840 ppm ethylbenzene, 3,500 ppm benzo(a)pyrene and 126 ppm naphthalene. Other hazardous substances associated with the waste are toluene, styrene, and hydrogen sulfide.

The evaporation ponds 1B and 1C are visible in aerial photos from November 1946 through September 1965 (3). Pits 1B and 1C were covered when viewed in an October 1967 photo. The evaporation ponds 1B and 1C are approximately 9 feet deep; they were used for the evaporation of liquid waste. According to workers, the solids in the bottom of the evaporation ponds were periodically excavated and transported off-site. The surface soils for the evaporation ponds are approximately 2 to 4 feet thick. The waste material in ponds 1A and 1C resemble clayey sludge and are typical of fine particles expected to settle out of water in evaporation ponds.

Though the waste pits have been covered for some time, there is evidence from aerial photos that the fill may not always have been intact (25). For instance in 1984, Dames and Moore, contractors for the responsible parties, noted that pond 1C had areas lacking soil cover, resulting in waste materials being exposed at the surface. Since 1983, there has been a fence around the pits restricting access. Currently there is a fence preventing access to the waste pits area.

According to local residents, children often played there and could have experienced exposure to the waste material as well as the fill material through skin contact, breathing the dust and incidental ingestion of the material.

Shallow soil sampling was collected as part of an early investigation of the waste pit contamination. In 1987, Woodward-Clyde collected soil from 1 foot below ground surface (bgs) at several locations around the disposal pits and one location around the evaporation ponds (22). No PAHs and no VOCs were detected in the sample taken near the evaporation pond. Three samples collected at 1 foot bgs around the disposal pits were analyzed for VOCs. Two of the samples had no detectable VOCs. One sample taken near pit 2D had a concentration of 9.9 ppm VOCs. Seven samples collected at a depth of 1 foot had PAHs ranging from 0.59 to 7.3 ppm.

Very limited surface soil sampling has occurred in and around the waste pits. As a part of the Phase I Remedial Investigation, one composite sample was collected from the disposal pits and one composite sample was collected from evaporation ponds (1). The chemicals that were detected in the samples are summarized in Table 11. No chemicals of concern related to operations at the Del Amo exceed health comparison values. Arsenic levels in both samples exceed the health comparison value but are within the typical range of background soil. The sample collected from the disposal pits slightly exceeds the health comparison value for DDT.

CDHS staff have heard from residents that children used to play in and around the waste pit area before it was fenced in 1981, and even after that when the fence was broken. CDHS evaluated exposure to a child (7 to 16 years of age) who played five times a week at the waste pits for ten years. We evaluated the exposure that the child would have received if he/she had contact directly with the waste material because it was exposed at the surface. We used the maximum concentrations of benzene, ethylbenzene, naphthalene, and benzo(a)pyrene detected in disposal pit 1F, the pit with the least fill cover and where the waste material has been visibly seen. We did not evaluate exposure to the surface soil since there were no site-associated contaminants in the surface soil.

The cancer risk to the child trespasser who is exposed to the maximally-contaminated waste materia in the waste pit 1F is 1 in 10,000, this is considered a low increased cancer risk. The estimated exposure for ethylbenzene and naphthalene do not exceed their non-cancer health comparison values, indicating that non-cancer health effects from exposure to these chemicals would not be expected. There are no non-cancer health comparison values for benzene and benzo(a)pyrene, the primary concern with these chemicals is their carcinogenicity.

Exposure to Air Emissions from the Waste Pit Area Before It Was Capped

Summary: Based on available data, air emissions from the contamination in the waste pit area did not pose a health hazard before it was capped. If the waste material had been disturbed, VOCs (for example benzene and ethylbenzene) would be released in large amounts. Even the

undisturbed waste emitted chemicals to the air through the fill material. However, air measurements taken around the waste pits indicated the waste pit emissions did not significantly affect the air quality in the area.

In addition to exposure that may have come from direct exposure to the waste material or the surface soil around the waste pits, there is also the concern for exposure from air releases from the waste pits before they were capped. As described previously, the waste pits received waste material from the synthetic rubber manufacturing process which contained VOCs. These chemicals can evaporate from the waste over time and be released to the air. By the early 1980s all of the waste pits had been covered with fill material. The fill material would tend to slow down the volatilization of the contaminants in the waste, but the VOCs to lesser extent will continue to be released from the waste material into the fill material and then into the air. These emissions contribute to the air quality in the area. There were residences nearby the waste pit area. In addition, there are nearby workers that could have been exposed to these emissions.

Emissions from the waste material have been evaluated by several different methods. In 1984, the emissions were measured from soil borings (22). This data indicated if the waste was disturbed, significant levels of benzene, toluene, ethylbenzene, xylenes, styrene, and hydrogen sulfide would be released. The data also suggested that the emissions could be approximately 10 times greater from the disposal pits than from the waste pits. Emission measurements indicated that emissions increase with depth in the waste. Furthermore, the waste material usually showed high peak readings followed by a slow decrease over the next hour to relatively constant emission rates.

In 1984, the DTSC contractor also measured emissions coming from the undisturbed waste pits using a device called a flux chamber (22). Peak surface flux emissions of total hydrocarbons from the pits ranged from 0.031 to 0.55 milligrams per square meter per minute ($mg/m^2/min$). Air measurements taken over the pits ranged from 0.1 to 1.96 ppm, while peak upwind concentrations ranged from 0.01 to 1.3 ppm. Average upwind air concentrations in air measured as total hydrocarbons ranged from 0.01 to 0.46 ppm. Average concentrations over the pits ranged from 0.10 to 1.7 ppm. This data seems to indicate that emissions from the waste pits did occur before the pits were capped, and that the emissions were an additional source affecting air quality in the area.

To further investigate the impact that soil gas from the waste pits may be having on the air quality, contractors for the responsible parties with oversight from the USEPA contractors conducted flux chamber and air sampling around the waste pits in 1994 and 1995 (43). CDHS has previously reviewed this data, the following is a summary of the sampling and our findings about the health impact of the data.

During the same days that ambient air sampling were collected in August and September 1994, emissions from the waste pits were measured using a flux chamber (43). Each day a different location on each pit was sampled; the locations were biased to “worst-case” scenarios as they were placed over surface cracks, animal burrows, boreholes from previous investigations, surface depressions, and areas of thin fill. Samples were collected for 4 hours, during the warmest hours of the day (11 AM and 4 PM). The flux chamber samples were analyzed for VOCs in both the first and second sampling effort and for SVOCs, and hydrogen sulfide in the first sampling event only. This is because SVOCs and hydrogen sulfide were either not detected or were detected at very low concentrations in all samples collected during the first round. The highest flux chamber measurement was 180 ppb benzene. This corresponds to an ambient air level of 0.98 ppb. This exceeds the health comparison value for benzene (0.03 ppb, CREG) (38). Except for benzene, all ambient air levels estimated from the surface flux chamber results would be below health comparison values.

Air monitoring was conducted at eight monitoring stations around the perimeter of the waste pit area: two on the north side; four on the south side between the waste pits and the community; and one each at the east and west ends (43). For the first round of sampling that was conducted August 30 to September 2, 1994, each location had wind-controlled VOC and SVOC samplers and a non-directional hydrogen sulfide sampler. This means that at each location, air was collected by one set of the VOC and SVOC samplers when the wind was blowing from the waste pits toward that sampler. Another set of VOC and SVOC samplers at each location collected the air when it was not coming from the direction of the waste pits (when it was blowing in toward the pits). During this sampling effort, 48 samples were collected when the wind was coming from the direction of the waste pits and 48 samples collected when the wind was not blowing from the waste pits. For 17 of the 48 pairs of matched samples the concentration of benzene in air from the waste pits exceeded the air not coming off the waste pits. For 24 of the 48 matched pairs, the concentration of benzene in the air sample coming off the waste pit was lower than the benzene coming from other directions. Seven of the times, the matched pairs were equal. This data seems to indicate that there may be emissions emanating from the waste pits but these emissions do not play as large a role on air quality as other sources.

During the second sampling event (September 6 to 9, 1994), ambient air samplers were non-directional (43). During the second event, two additional locations were added to the sampling effort, two backyards along 204th Street (Table 12). CDHS reviewed this data in a health consultation released in 1996 (43). In that document, CDHS concluded that there were low levels of VOCs, SVOCs, and hydrogen sulfide in the ambient air, and for the majority of the chemicals the levels were either below health comparison values or comparable to background levels of these chemicals in the Los Angeles area. Three contaminants (hydrogen sulfide, p-isopropyltoluene, and tetrachloroethylene) were measured at levels above health comparison values. Upon further examination, the estimated non-cancer exposure levels were below health comparison values, thus non-cancer health effects would not be expected from exposure to these contaminant levels in the air.

Exposure to the Waste Pit Area After It Was Capped

Summary: The responsible parties as ordered by the USEPA capped the waste pits area in 2000. This eliminates any current or future exposure and emissions from the waste pits at the site.

In 2000, the responsible parties capped the waste pits with a Resource Conservation and Recovery Act (RCRA)-cap. A RCRA-cap is a multi-layer cap that prevents direct contact with the contaminants, prevents generation of runoff and wind blown dust, and prevents rainwater from washing through the pits and the contaminated soil beneath the pits and carrying contaminants to the groundwater. Thus, there is currently no exposure to the waste material occurring to a trespasser, nearby resident, or visitor to the neighborhood to the south. (The soil gas from beneath the waste pits will be collected and treated after the treatment technology has been decided upon and put in place, see next pathway for a discussion of the health hazard from the treatment system.)

Exposure to Releases from the Treatment of Soil Gas Captured from under the Waste Pit Cap

Summary: Another aspect of the treatment strategy for the control of the waste pit contamination consists of a system below the waste pits to keep chemicals from moving into the groundwater. This system pulls the volatile chemicals in the soil below the waste material to the surface. At the *surface the material needs to be treated. So far the treatment strategy has not been selected by the USEPA. CDHS and ATSDR recommend that the potential health impact of the treatment strategy be evaluated before the selection is made.*

The soil below the waste pits and above the groundwater table is contaminated with SVOCs and VOCs. In order to prevent further spread of the contamination from the soil to the groundwater, the soil is treated to remove the soil contamination. The treatment system consists of a series of underground wells placed in the area around the waste pits and a vacuum system that pulls the soil contamination that has volatilized (soil gases) to the surface. The primary soil gases of concern are benzene and ethylbenzene. These gases need to be treated after they are brought to the surface.

The responsible parties installed the waste pit cap and the soil vapor extraction system in 1999. Thermal oxidation was the soil gas treatment system that was originally selected by USEPA and the responsible parties. Thermal oxidation, sometimes referred to as incineration, uses high temperatures to destroy the contaminants. The use of thermal oxidation has the potential of producing/ produces dioxins and furans. There is a great deal of concern about the health impact of dioxins and furans at low levels and this led the community activist and the community around the Del Amo site to request another treatment system be used.

Through the Del Amo/Montrose Partnering Process that is described in the community concerns section, a number of other soil gas treatment systems were evaluated. In particular the group studied, alternative technologies. Alternative technologies are treatment and collection systems that give the promise of being more environmentally friendly than thermal oxidation.

The partners considered the following types of technology:

- granular activated carbon- collects the contaminants in carbon filters, the carbon filters have to be treated on site or off site;
- biofiltration- uses bacteria to break down the contaminants;
- resin absorption-collects the contaminants in synthetic resin filters, the resin filters have to be treated on site or off site;
- electrochemical oxidation- uses a chemical reaction to break down the contaminants.

The partners reviewed a variety of commercially available options using the technologies described above. As a part of the review process, the partners evaluated whether the option was capable of being applied to Del Amo given the composition of the soil gas, the flow rate, as well as other issues related to the treatment technology. Of particular concern were the overall health and safety aspects of the process. For instance, does the process result in another form of contamination (resin, charcoal) and how this material would then need to be treated or disposed. Does the process use a highly combustible material that would thus be stored in large quantities near the waste pits? At the end of the review process, the partner group found the resin absorption-collects the contaminants in synthetic resin filters and to have the resin filters reactivated on-site to be the best choice.

As of June 2002, USEPA began preparing a directive to the responsible parties to investigate and recommend a specific adsoprtion system to use.

Indoor Air Exposure in the Residential Area South of the Site

Summary: It is theoretically possible that indoor air in buildings located to the south of the Del Amo site may be affected by the contaminated groundwater flowing underneath their homes. CDHS estimates of indoor air levels indicate that the groundwater does not pose a health hazard to residents living south of the site.

Groundwater south of the site is contaminated. The upper most water table is contaminated with VOCs and SVOCs. This water table flows underneath houses and condominium complexes. In cases when the groundwater is close to the surface, the VOCs in the groundwater can be pulled into buildings. Once inside the building, these gases can be inhaled.

While soil gas can be an important source of in-building air contaminants, it is only one of several contributors to the total air contaminants found inside a building (33). Other sources of indoor air contaminants include the chemicals contained in the ambient (background) air, chemicals released into the building by the building components, contents, and processes that use chemicals.

As described previously, the shallow contaminated groundwater table in the Del Amo site area is found about 47 to 70 feet bgs (3). It is generally been found that groundwater deeper than 30 feet from the surface would not affect the indoor air quality of a building above it. However, because the impact can be evaluated using the modeling methodology described previously, CDHS staff evaluated this pathway.

We evaluated indoor air affects for two regions of the neighborhood to the south, in the direction that the groundwater plume is moving. These two areas of the groundwater plume differ somewhat in the types of contaminants and level of these contaminants. The first area that we evaluated is located on the western side of the plume, near the northern end of Kenwood Avenue (Figure 4). The second region of the plume that we evaluated is on the eastern side of the plume in the area of Berendo Street. The first region generally has higher amounts of chlorobenzene compared to benzene, i.e. contamination due to Montrose rather than Del Amo. The second region of the plume has higher amounts of benzene compared to chlorobenzene. In addition, this part of the plume has other organic chemicals detected in the groundwater, like vinyl chloride and naphthalene. It appears that this region may have other sources (Gardenia Landfill #4) contributing to the groundwater contamination.

The results of the toxicological evaluation for indoor air exposure are shown in Table 13. The exposure parameters and assumptions used in evaluation are discussed below the table. The cancer risk to the resident living on the western side of the neighborhood from the groundwater impacting their indoor air is 4 in 10,000,000, this is considered a no apparent increased cancer risk. The cancer risk to the resident living on the eastern side of the neighborhood from the groundwater impacting indoor air is 8 in 100,000,000, this is considered a no apparent increased cancer risk. None of the estimated indoor air concentrations exceed the non-cancer health comparison values, indicating that non-cancer health effects would not be expected for the residents living overtop the groundwater plume.

This information is supported by the indoor air sampling that USEPA conducted in 1994 in 25 houses directly south of the waste pits. These houses were part of the buyout area. CDHS reviewed the indoor air in a health consultation (32). In summary, we found that a wide variety of SVOCs and VOCs were detected in the indoor air samples; the levels detected were either below the Los Angeles indoor air reference levels and/or below the health comparison levels. The levels of benzene at two locations were elevated and the indoor air level of tetrachloroethylene was elevated. Tetrachloroethylene is not a groundwater contaminant in the area. The USEPA conducted further investigation of the elevated benzene levels. They removed an old stove in one house and several common household products in another house that they determined were possible sources of benzene. They retested the houses and the levels of benzene were much lower, within typical levels found in Los Angeles air.

Soil Exposure in the Residential Area South of the Site Before the Buyout

Summary: Based on soil investigations in and near the residential neighborhood south of the Del Amo site, exposure to adult and children to surface soils does not present a health risk related to Del Amo-related contaminants. The surface and shallow subsurface soil in the neighborhood contained elevated levels of DDT. There have been several excavations to remove the DDT contamination. Arsenic and cadmium have been detected at levels exceeding typical western soils and health comparison values. Arsenic and cadmium are not related to activities at the Del Amo site. There have also been detections of other chemicals that could be related to the Del Amo site.

If contamination has spread from the site to the neighborhood soil to the south, residents, visitors, off-site workers could get exposed to that soil contamination in a variety of ways. Skin contact, inhalation of soil dust, and incidental soil ingestion are likely routes of exposure for people to contaminated soil. Incidental soil ingestion is likely if a person eats, drinks, smokes or participates in recreational or occupational activities near soil containing contaminants. For residential yards and recreation areas, soil ingestion can be an important route of exposure, especially for children less than 6 years of age. Soil ingestion is greater for younger children because they tend to put their hands in their mouths more often.

On several occasions, surface (less than 6 inches) and shallow (1-3 ft) soil sampling has occurred in the neighborhood south of the Del Amo site. Several of the sampling efforts focused only on DDT and its breakdown products. In the following discussion, we will present and review the sampling data for those sampling efforts where compounds other than DDT were also included in the analyses (Table 14).

In 1983, during excavation activities for waste pond 1A, soil samples were taken from 0 to 1 foot bgs and 2 to 3 feet bgs from nine residential backyards across from the waste pits, as well as one sample from a yard located 2 miles further south which was sampled for background (5). The samples were analyzed for metals, VOCs, PAHs, base/neutral extractables and chlorinated pesticides. DDT and its breakdown products were detected in the soil, though not at levels that exceed the health comparison levels. No detectable concentrations of VOCs and SVOCs were reported. Selenium levels in all samples exceed typical western soil concentrations (31); however, the levels do not exceed the health comparison value. (Later testing seems to indicate that these selenium readings were inaccurate.) Arsenic and cadmium levels in two locations exceed background levels reported for soil in the western United States (31). The arsenic levels exceed the health comparison value for soil; whereas the cadmium concentrations do not exceed the health comparison value for soil.

In September 1993, in response to a recommendation for additional off-site soil sampling made in the previous PHA, consultants for the responsible parties took surface soil samples in the backyards and side yards and undeveloped land along Del Amo Boulevard to the south of the Del Amo site (6). They took 21 composited samples. The composites were drawn from the top 6 inches of soil from four subsamples taken from 3 feet in each direction from the point. Samples were analyzed for SVOCs, DDT and its breakdown products, and metals from a designated target list. Very low levels of several SVOCs were detected in nine of the samples (Table 14) Except for one detection of benzo(a)pyrene, the other SVOCs did not exceed their health comparison values. DDT was found at levels above health comparison values in several samples. Arsenic, cadmium, copper, lead, and zinc were found in some of the samples at levels exceeding typical background levels (31). Of these metals, the levels of arsenic, cadmium, and lead exceed the levels of health concern for soil.

Because of the DDT that was found in the 1993 surface testing, consultants for the responsible parties took additional surface soil samples from the yards of 1051 and 1055 204th Street in February 1994 (7). The samples were analyzed for pesticides and PCBs. No other chemicals except DDT were detected.

As a part of another study to delineate the extent of DDT contamination along 204th Street, USEPA and their consultants collected subsurface soil on twenty-eight properties in June and July 1994 (8). They collected 232 subsurface soil samples from 51 locations. Samples were collected every 3 feet from the surface to approximately 18 feet down. No surface (less than 6 inches) soil samples were collected. In addition to DDT, 87 of the samples were analyzed for VOCs by radioassay in the field and 91 of the samples were sent to the laboratory for analysis of SVOCs and PCBs. No VOCs were detected. No other pesticides besides DDT and its breakdown products were detected in any of the shallow surface soil samples (3 ft and less). Three shallow surface soil samples had detectable levels of SVOCs. In one of the samples, benzo(a)anthrancene (0.20 ppm), benzo(a)pyrene (0.4 ppm) and benzo(b)fluoranthene (0.28 ppm) were detected at levels exceeding their health comparison values.

Consultants for the USEPA conducted additional subsurface soil testing in October 1995 to further delineate the subsurface soil contaminated with DDT behind 1051 and 1055 204th Street; in an area where metal slag was found; in the area between the 1043, 1041, and 1039 204th Street duplexes; and in the areas adjacent to DDT removal that was conducted in 1994 (9). Soil samples were collected from 6 inches to 8.5 feet at 2 foot intervals. All soil samples were field tested for DDT. Some of the samples were sent to the laboratory for analysis of VOCs, SVOCs, pesticides, herbicides and metals. Thirty of the surface soils and 15 of the shallow subsurface (1.5-2.5 ft) were sent to the laboratory for metal analysis. Of these samples, only three surface and two shallow subsurface soil samples were analyzed for arsenic. Many of the surface and shallow subsurface samples had levels of cadmium, copper, lead, and zinc that exceed the typical background for western soils (31); however, the levels of copper, lead and zinc do not exceed their health comparison values. Two of the surface and one of the shallow subsurface soil samples had levels of cadmium that exceed the health comparison value. The five samples analyzed for arsenic were within typical levels for western soils though the levels exceed the health comparison value (31). Five surface and three shallow subsurface samples were analyzed for VOCs; low levels of total VOCs (2.17 and 1.85 ppm) were detected in two the of eight samples. Four surface and two shallow subsurface soil samples were analyzed for SVOCs, pesticides/PCBs, and herbicides. Except for DDT and its breakdown products no other chemicals were detected in these six samples.

Taken together, this data suggests that DDT, arsenic (though not consistently elevated above typical western soils) and cadmium should be considered contaminants of concern in the surface and subsurface soil. DDT is a contaminant of concern related to the Montrose site not the Del Amo site. There have also been occasional detections of lead, benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene above health comparison values. These chemicals will also be considered contaminants of concern.

DDT removal actions took place in 1994 and 1995 at 1051 and 1055 204th Street. These DDT-related removal actions did not include the removal of soil from some of the sampling locations where arsenic, cadmium, and the other chemicals were found above health comparison values.

CDHS estimated the exposure for an adult and child who spend time gardening, playing, or doing some other activity in their backyards in the neighborhood south of Del Amo. We assumed the adults spent every day of the week for 52 weeks of the year for 30 years in their backyards. For children, we assumed that they spent every day from 6 months to 5 years of age, and from 5 to 12 years of age we assumed they spent every weekend day in the backyard. The maximum concentration of arsenic, cadmium, benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene in surface soil (6 inches or less bgs) were used for the dose calculations of the backyard activity exposure. CDHS assumed that the adult resident ingests 50 mg/day of soil and the child ingests 100 mg/day of soil, and that the entire contribution is from the backyard soil.

The estimated dose for adult residential exposure to soil in the backyard does not exceed the non-cancer health comparison values for arsenic and cadmium which means that non-cancer health effects would not have been expected to occur when an adult resident spends time in area in the backyard being exposed to the maximum levels of chemicals of concern in the soil. Similarly, a child playing in the backyard would also not be expected to experience any non-cancer health effects from exposure to the soil.

A very low increased cancer risk (3.5 in 100,000) may exist for adults who have come into contact with soil containing the maximally measured levels of arsenic and PAHs in the soil on a routine basis for 30 years and a very low increased cancer risk (7.3 in 100,000) may exist for children.

The residents south of the Del Amo waste pits were bought out of their property, so there is no current or future exposure for residents. The buyout area is to be a park (see next section for a discussion).

Soil Exposure in the Residential Area South of the Site After the Buyout

Summary: The responsible parties for the Del Amo site bought approximately 55 homes located south of the waste pits area. These homes have been removed. The responsible parties graded the property in preparation for it to become a county park. As part of the grading, the responsible parties contractors were directed by DTSC to collect the "blue lava rock-like material" that community members had seen on the property and place it at a depth of 3 to 5 feet below the surface where the basketball court is planned. This blue lava rock-like material contains elevated levels of arsenic, lead, copper and zinc. Testing of the surface soil after the grading did not find DDT or metals at elevated levels, indicating that the surface soil does not pose a health hazard. The county's recent subsurface sampling is not relevant to human health exposure, but they also collected one surface soil sample which contained no detectable levels of pesticides and no elevated metals. Slag material gathered by the county contained some elevated metals, this material should be removed before the park is created

In the late 1990s, approximately 65 properties containing 55 homes including the properties that contained the elevated DDT levels, were bought by the Del Amo responsible party (24). Based on the input of a community advisory panel, the buyout area is being developed for a park. As part of the park development, there needed to be some grading of the property. Before this grading occurred, community members identified several foreign materials in the surface soil in the future park. In particular the community was concerned about "blue lava rock-like material" and "slag-like material". DTSC staff, accompanied by community members, examined the material and took samples for analysis at the laboratory. The slag-like material was found in the vicinity of 1041 and 1041½ 204th Street. The blue lava rock-like material was found at 1005 West 204th Street. Analyses of the blue lave rock-like material showed that it contained high levels of arsenic, lead, copper, and zinc. The slag-like material did not contain elevated levels of metals.

During the grading that took place, the slag-like material was segregated and buried under 2 feet of non-slag impacted soils where the proposed asphalt parking lot will be located (24). The blue lava rock-like material was hand consolidated under DTSC's oversight and was subsequently buried in a trench located 7 feet bgs, adjacent to and below the southern portion of the proposed basketball court.

Development of the park required that 1650 cubic yards of non-expansive import soil be placed for fill below the community center's building foundation/slab and the satellite restroom-building slab (24). The import soil was tested for environmental contamination (metals, PCB and pesticides, herbicides, total petroleum hydrocarbons, VOCs, SVOCs) before it was allowed to be brought to the site.

To ensure that the surface soil was safe to be used for park use, the responsible parties were asked to conduct post-grading surface soil testing (24). Field testing was conducted for DDT. Eight randomly pre-selected samples and two additional samples were sent to the laboratory for confirmation DDT analysis and for metal analysis (Table 15). No chemicals were detected at a level of health concern in the soil samples.

As part of its investigation of the buyout area before taking it over to create a park, Los Angeles County Department of Public Works conducted a site assessment of the property. The stated purpose of the site assessment was to "identify subsurface conditions that may have been impacted by adverse environmental conditions at the site". The field sampling activity took place from November 9-13, 2001. The county drilled 19 soil borings, collecting samples starting at 5 feet and then every 5 feet to the depth of interest. In the field, they used a photoionization detector (PID) to determine the presence of any soil vapors in the subsurface soil samples. The county collected grab water samples when groundwater was encountered during the boring (7 of the 19 borings), collected slag material surface soil samples and composited like material into five different samples, and collected one shallow soil sample. The water and soil samples were submitted to a laboratory for total petroleum hydrocarbons, VOCs, metals, organochlorine pesticides, and and organochlorine herbicides.

For most of the 135 samples collected from the 19 borings, no organic chemicals were detected and all the metals were within levels considered typical of background. Total petroleum hydrocarbons (TPH) were found in 29 of the 135 samples. Of those 29 samples with TPH, two had elevated lead (2420 and 2340 ppm). Three of the 29 samples had elevated cadmium (23, 30.2 and 11.9 ppm). At depths of 45 - 50 feet, where they began encountering water, 13 soil samples contained VOCs in addition to TPH. The VOCs included 1,2-dichloroethane, naphthalene, 1,3,5-trimethylbenzene, 1,2,4-trimethylbenzene, n-propylbenzene, trichloroethylene. DDT was detected in two samples (0.63 and 1.53 ppm total DDT)

Because the soil borings were taken at depths of five feet below ground surface and deeper, CDHS did not consider this data relevant to evaluate exposure of visitors to the park or park staff working on the landscape. Occasional digging into this area would not pose a health risk to a utility worker; however, such digging could bring this material to the surface where others could be exposed to it for longer periods of time.

County park staff collected a near-surface soil sample at 1 foot bgs in the middle of the park. This sample did not contain any elevated metals and no pesticides including DDT were detected.

County park staff collected slag material collected from the surface and grouped the material into five samples described as crystallized metal, metal blocks, granular brick, green glass, and metal pieces. These samples were analyzed for metals, the crystallized metal sample contained elevated arsenic (62.6 ppm). The metal block sample contained elevated nickel (1430 ppm). The other three samples did not contain any metals elevated above background or health comparison values.

Based on these results, the surface soil does not pose a health concern for future workers or visitors (children and adults) to the park when it is developed. All slag material should be removed before the park is created.

Limitations with the Investigations Described in this Public Health Assessment

Limitations in the scope of an investigation and/or lack of sufficient data can be a source of uncertainty associated with any scientific investigation. It is the view of the authors of this document that the limitations and data gaps do not compromise the conclusions of this PHA. However, a variety of uncertainties must be taken into account when considering the strength of the conclusions and the recommendations made. The recommendations presented in this document in the Public Health Recommendation and Action section are aimed at addressing the limitations.

ATSDR Child Health Initiative

ATSDR recognizes that infants and children may be more sensitive than adults to environmental exposures. This sensitivity is a result of several factors: 1) Children may have greater exposures to environmental toxicants than adults because pound for pound of body weight, children drink more water, eat more food, and breathe more air than adults; 2) Children play outdoors close to the ground which increases their exposure to toxicants in dust, soil, surface water, and in the ambient air; 3) Children have a tendency to put their hands in their mouths while playing, thereby exposing them to potentially contaminated soil particles at higher rates than adults (also, some children ingest non-food items such as soil which is a behavior known as "pica"); 4) Children are shorter than adults, which means they can breathe dust, soil, and any vapors close to the ground; 5) Children grow and develop rapidly, they can sustain permanent damage if toxic exposures occur during critical growth stages; and 6) Children and teenagers may disregard "No Trespassing" signs and wander onto restricted locations. Because children depend on adults for risk identification and management decisions, CDHS and ATSDR is committed to evaluating their special interests at hazardous waste sites as part of the ATSDR Child Health Initiative.

As described in the previous discussions, CDHS evaluated residential, including childhood exposure, for homes south of the Del Amo site and for children that may attend day-care at a building located on the Del Amo site.

Conclusions

ATSDR requires that the site be assigned a hazard ranking based on exposure pathways, susceptibility of the population, and the likelihood the exposure could result in adverse health effects. We ranked the site on the basis of our evaluation of nine pathways of possible exposure related to the Del Amo site: two for the developed portion of the site, four related to the waste pits, and three specific to the neighborhood located south of the site. Based on this, CDHS determined that the site posed a health hazard in the past, poses a health hazard now, and is an indeterminate health hazard in the future. The following is a summary of the evaluation for each of these pathways.

* Based on soil investigations in those exposed areas of the developed portion of the site, exposure to long-term workers, occasional workers, and children at a daycare does not present a health hazard related to Del Amo-related contaminants. Limited surface and shallow soil sampling in the developed portion of the site indicates that there are several chemicals not related to the Del Amo site (arsenic, DDT and Arochlors/total polychlorinated biphenyls (PCBs)) found at levels of health concern. For the long-term worker and occasional worker, these non-site related chemicals pose an insignificant to slight increased cancer risk. The chemicals measured in the soil would not result in non-cancer health effects for long-term workers, occasional workers, or children in the daycare. Since soil testing was only conducted in the exposed areas of the site, when a building is torn down or a parking lot removed, there is the potential for contaminated soil to be exposed.

* The groundwater under and around the Del Amo site is contaminated with various chemicals arising from the Del Amo and Montrose sites as well as other nearby sites. Currently there are no domestic, irrigation, or industrial wells pulling water from the contaminated groundwater, thus no one has been exposed and no one is being exposed through the use of the water as drinking water. If the groundwater is cleaned up and contained as planned, the groundwater contamination will not spread to the drinking water wells and thus there is no concern for future exposure from using the groundwater as drinking water.

* Indoor air in buildings located on the developed portion of the site may be affected SVOC nearby contaminated soil or groundwater. CDHS estimates of indoor air impacts from contaminated soil using modeling indicate that chemicals coming from the beneath the building in areas where there is LNAPL may contribute to a very low increased cancer risk and a possibility though unlikely of non-cancer health effects for the long-term worker in that building. A child attending daycare could but is also unlikely to experience non-cancer health effects from these estimated level of exposure to benzene from the LNAPL. For those buildings in the developed portion of the site where there is no LNAPL, cancer or non-cancer health impacts are not expected for the long-term worker, the occasional worker, or the child attending daycare. There are many assumptions in modeling this exposure that may influence the validity of these findings. Sampling conducted in 13 buildings on-site, including a building over LNAPL, indicate that indoor air quality is similar to typical indoor air.

* Based on available data, direct contact with the contamination in the waste pit area posed a health hazard before it was capped. Though the waste pits were covered with fill as far back as the 1950s and fenced in the 1980s, there are reports that children played at the waste pits and the waste material has been seen at the surface. The waste material is high in PAHs and VOCs, most prominently are naphthalene, benzo(a)pyrene, benzene, and ethylbenzene. Limited surface soil testing over the waste pits indicate that soil would not pose a health hazard. However, frequent

playing with the waste material posed a health hazard to children. The estimated exposures related to the contaminated waste material present a low increased cancer risk (2.8 in 10,000) and non-cancer health effects related to benzene exposure to children who played with the waste on a fairly regular basis. The waste pits are now capped eliminating this exposure.

* Based on available data, emissions from the contamination in the waste pit area did not pose a health hazard before it was capped. If the waste material is disturbed, VOCs (for example benzene and, ethylbenzene) are released in large amounts. Even the undisturbed waste emitted chemicals to the air through the fill material. However, air measurements taken around the waste pits indicate the waste pit emissions do not significantly affect the air quality in the area.

* The responsible parties as ordered by the USEPA capped the waste pits area in 2000. This eliminates any current or future exposure and emissions from the waste pits.

* An aspect of the treatment strategy for the control of the waste pit contamination consists of a system below the waste pits to keep chemicals from moving into the groundwater. This system pulls the VOCs in the soil below the waste material to the surface. At the surface the material needs to be treated. So far the treatment strategy has not been selected. (See the recommendation related to this exposure pathway.)

* It is theoretically possible that indoor air in buildings located to the south of the Del Amo site may be affected by the contaminated groundwater flowing underneath their homes. CDHS estimates of indoor air levels indicate that the groundwater does not pose a health hazard to residents living south of the site.

* Based on soil investigations in and near the residential neighborhood south of the Del Amo site, exposure to adult and children to surface soils does not present a health risk related to Del Amo-related contaminants. The surface and shallow subsurface soil in the neighborhood did contain elevated levels of DDT and there have been several excavations to remove the DDT contamination. Arsenic and cadmium have been detected at levels exceeding typical western soils and health comparison values. Arsenic and cadmium are not related to activities at the Del Amo site. There have also been detections of other chemicals that could be related to the Del Amo site.

* The responsible parties for the Del Amo site bought approximately 55 homes located south of the waste pits area. These homes have been removed. The responsible parties graded the property in preparation for it to become a county park. As part of the grading, the responsible parties contractors were directed by DTSC to collect the “blue lava rock-like material” that community members had seen on the property and place it at a depth of 3 to 5 feet below the surface where the basketball court is planned. This blue lave rock-like material contains elevated levels of arsenic, lead, copper and zinc. Testing of the surface soil after the grading did not find DDT or metals at elevated levels, indicating that the surface soil does not pose a health hazard.

Public Health Recommendations and Action Plan

Recommendations for Further Actions

1. Ensure that the integrity of the cap over the waste pit area is maintained. (USEPA or some other agency)

2. Ensure that the fences are maintained to prevent tampering with the soil vapor treatment system. (USEPA)

3. Evaluate the health and safety issues for the soil gas treatment system. (USEPA or some other agency)

4. Ensure that future construction activities (removal of parking lots or buildings in the developed portion of the site) incorporate erosion control and dust mitigation mechanisms. (USEPA)

5. When parking lots or buildings are removed, constructed or remodeled or another major activity occurs that will result in the exposure of soil on the developed portion of the site, conduct soil sampling. (USEPA, county or city planning department or some other agency, responsible party or land owner)

7. Conduct air sampling in buildings near where LNAPL and soil contamination exists aimed at places in the floor where penetrations of the slab exists, this will ensure that the soil gas pathway is not a major contributor to the indoor air quality in these buildings. Tests buildings over LNAPL and manipulate the building's heating and cooling system so as to maximize soil gas influx during measurements. If contamination at a level of health concern is found, eliminate or reduce the exposure. (USEPA)

8. Ensure that future construction activities incorporate erosion control and dust mitigation mechanisms. (USEPA, SCAQMD or other agencies)

9. Remediate groundwater so that the contamination will not affect municipal wells in the future. (USEPA)

Public Health Actions Currently Underway

1. USEPA is in the process of making a decision about how to treat the soil gas that is being captured from underneath the waste pit area.

2. USEPA is the process of summarizing the site characterization data for the developed portion of the site and issuing a risk assessment.

3. CDHS continues to conduct public health assessment, community outreach, and health education activities related to both the Montrose and Del Amo sites.

Public Health Actions Completed

1. CDHS has conducted many PHA and health education activities related to the Del Amo and Montrose sites (see Appendix E).

2. Under USEPA and DTSC's oversight the waste pit area has been capped.

3. Under USEPA and DTSC's oversight a soil vapor extraction system has been installed at the waste pits.

4. A USEPA Record of Decision (ROD) has been issued for the groundwater cleanup. However, the cleanup activities have not yet been implemented

5. As a part of the 1997, USEPA placed deed restrictions on the two land parcels constituting the waste pits area.

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72. Agency for Toxic Substances and Disease Registry. Toxicological profile for tetrachloroethylene. Atlanta: US Department of Health and Human Services: September 1997.

73. Agency for Toxic Substances and Disease Registry. Toxicological profile for toluene. Atlanta: US Department of Health and Human Services: September 2000.

74. Agency for Toxic Substances and Disease Registry. Toxicological profile for trichloroethylene. Atlanta: US Department of Health and Human Services: September 1997.

75. Agency for Toxic Substances and Disease Registry. Toxicological profile for xylenes. Atlanta: US Department of Health and Human Services: August 1995.

Appendix A - Glossary

GLOSSARY

Adverse Health Effect
A change in body function or the structures of cells that can lead to disease or health problems.

ATSDR
The Agency for Toxic Substances and Disease Registry. ATSDR is a federal health agency in Atlanta, Georgia that deals with hazardous substance and waste site issues. ATSDR gives people information about harmful chemicals in their environment and tells people how to protect themselves from coming into contact with chemicals.

Background Concentration
An average or expected amount of a chemical in a specific environment. Or, amounts of chemicals that occur naturally in a specific environment.

Cancer Risk
The potential for exposure to a contaminant to cause cancer in an individual or population is evaluated by estimating the probability of an individual developing cancer over a lifetime as the result of the exposure. This approach is based on the assumption that there are no absolutely "safe" toxicity values for carcinogens. USEPA has developed cancer slope factors for many carcinogens. A slope factor is an estimate of a chemical's carcinogenic potency, or potential, for causing cancer.

If adequate information about the level of exposure, frequency of exposure, and length of exposure to a particular carcinogen is available, an estimate of excess cancer risk associated with the exposure can be calculated using the slope factor for that carcinogen. Specifically, to obtain risk estimates, the estimated, chronic exposure dose (which is averaged over a lifetime or 70 years) is multiplied by the slope factor for that carcinogen.

Cancer risk is the likelihood, or chance of getting cancer. We say "excess cancer risk" because we have a "background risk" of about one-in-four chances of getting cancer. In other words, in a million people, it is expected that 250,000 individuals would get cancer from a variety of causes. If we say that there is a "one-in-a-million" excess cancer risk from a given exposure to a contaminant, we mean that if one million people are exposed to a carcinogen at a certain concentration over their lifetime, then one cancer above the background chance, or the 250,000st cancer, may appear in those million persons from that particular exposure. In order to take into account the uncertainties in the science, the risk numbers used are plausible upper limits of the actual risk based on conservative assumptions. In actuality, the risk is probably somewhat lower than calculated, and, in fact, may be zero.

CERCLA
See Comprehensive Environmental Response, Compensation, and Liability Act.

Completed Exposure Pathway
See Exposure Pathway.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
CERCLA was put into place in 1980. It is also known as Superfund. This act concerns releases of hazardous substances into the environment, and the cleanup of these substances and hazardous waste sites. ATSDR was created by this act and is responsible for looking into the health issues related to hazardous waste sites.

Concern
A belief or worry that chemicals in the environment might cause harm to people.

Concentration
How much or the amount of a substance present in a certain amount of soil, water, air, or food.

Contaminant
See Environmental Contaminant.

Dermal Contact
A chemical getting onto your skin. (see Route of Exposure).

Dose
The amount of a substance to which a person may be exposed, usually on a daily basis. Dose is often explained as the amount of substance(s) per body weight per day.

Dose / Response
The relationship between the amount of exposure (dose) and the change in body function or health that result.

Duration
The amount of time (days, months, years) that a person is exposed to a chemical.

Environmental Contaminant
A substance (chemical) that gets into a system (person, animal, or the environment) in amounts higher than that found in Background Concentration, or what would be expected.

Environmental Media
Usually refers to the air, water, and soil in which chemicals of interest are found. Sometimes refers to the plants and animals that are eaten by humans. Environmental Media is the second part of an Exposure Pathway.

Environmental Media Evaluation Guide (EMEG)
EMEGs are media specific values developed by ATSDR to serve as an aid in selecting environmental contaminants that need to be further evaluated for potential health impacts. EMEGs are based on non-carcinogenic end-points and do not consider carcinogenic effects. EMEGs are based on the MRLs.

Exposure
Coming into contact with a chemical substance.(For the three ways people can come in contact with substances, see Route of Exposure.)

Exposure Assessment
The process of finding the ways people come in contact with chemicals, how often and how long they come in contact with chemicals, and the amounts of chemicals with which they come in contact.

Exposure Pathway
A description of the way that a chemical moves from its source (where it began) to where and how people can come into contact with (or get exposed to) the chemical.

ATSDR defines an exposure pathway as having five parts:
1. A Source of Contamination
2. Environmental Media and Transport Mechanism
3. Point of Exposure
4. Route of Exposure
5. Receptor Population

When all five parts of an exposure pathway are present, it is called a Completed Exposure Pathway

Groundwater
Water beneath the earth's surface that flows through soil and rock openings, and often serves as a source of drinking water.

Hazardous Waste
Substances that have been released or thrown away into the environment and, under certain conditions, could be harmful to people who come into contact with them.

Maximum Contaminant Level (MCL)
The USEPA has issued drinking water standards, or MCLs for more than 80 contaminants in drinking water. The MCLs are set based on known or anticipated adverse human health effects (which also account for sensitive subgroups, such as, children, pregnant women, the elderly, etc.), the ability of various technologies to remove the contaminant, their effectiveness, and cost of treatment. For cancer risk, USEPA generally sets the MCLs at concentrations that will limit an individual risk of cancer from a contaminant to between 1 in 10,000 (low increased excess risk) to 1 in 1,000,000 (no apparent increased excess risk) over a lifetime . As for non-cancer effects, USEPA estimates an exposure concentration below which no adverse health effects are expected to occur.

Non-Cancer Evaluation ATSDR's Minimal Risk Level (MRL) and USEPA's Reference Dose (RfD) and Reference Concentration (RfC)
The MRL, RfD and RfC are estimates of daily exposure to the human population (including sensitive subgroups), below which non-cancer adverse health effects are unlikely to occur. The

MRL, RfD and RfC only consider non-cancer effects. Because they are based only on information currently available, some uncertainty is always associated with the MRL, RfD. and RfC. “Safety” factors are used to account for the uncertainty in our knowledge about their danger. The greater the uncertainty, the greater the “safety” factor and the lower the MRL, RfD, or RfC.

When there is adequate information from animal or human studies, MRLs and RfDs are developed for the ingestion exposure pathway, whereas, RfCs are developed for the inhalation exposure pathway. A MRL, RfD or RfC is an estimate of daily human exposure to a substance that is likely to be without an appreciable risk of adverse (non-carcinogenic) health effects over a specified duration of exposure. No toxicity values exist for exposure by skin contact. Separate non-cancer toxicity values are also developed for different durations of exposure. ATSDR develops MRLs are acute exposures (less than 14 days), intermediate exposures (from 15 to 364 days), and for chronic exposures (greater than 1 year). USEPA develops RfDs and RfCs for acute exposures (less than 14 days), subchronic exposures (from 2 weeks to 7 years), and chronic exposures (greater than 7 years). Both the MRL and RfD for ingestion are expressed in units of milligrams of contaminant per kilograms body weight per day (mg/kg/day). The RfC for inhalation is expressed in units of mg/m^3 .

<u>Preliminary Remediation Goals (PRGs)</u>
PRGs are developed by the USEPA to estimate contaminant concentrations in the environmental media (soil, air, and water), both in residential and industrial settings, that are protective of humans, including sensitive groups, over a lifetime. PRGs were developed for both industrial and residential settings because of the different exposure parameters, such as, different exposure time frames (e.g., industrial setting: workers are exposed for 8 hours/day and 5 days/week vs. residential setting: families are exposed 24 hours/day and 7 days/week; and different “human” exposure points (e.g., industrial setting: healthy adult males vs. residential setting: males, females, young children, and infants), etc. Media concentrations less than the PRGs are unlikely to pose a health threat; whereas, concentrations exceeding a PRG do not automatically determine that a health threat exists, but suggest that further evaluation is necessary.

<u>NPL</u>
The National Priorities List. (Which is part of Superfund.) A list kept by the U.S. Environmental Protection Agency (EPA) of the most serious, uncontrolled or abandoned hazardous waste sites in the country. An NPL site needs to be cleaned up or is being looked at to see if people can be exposed to chemicals from the site.

<u>PHA</u>
Public Health Assessment. A report or document that looks at chemicals at a hazardous waste site and tells if people could be harmed from coming into contact with those chemicals. The PHA also tells if possible further public health actions are needed.

<u>Plume</u>
A line or column of air or water containing chemicals moving from the source to areas further away. A plume can be a column or clouds of smoke from a chimney or contaminated underground water sources or contaminated surface water (such as lakes, ponds and streams).

Point of Exposure
The place where someone can come into contact with a contaminated environmental medium (air, water, food or soil). For examples: the area of a playground that has contaminated dirt, a contaminated spring used for drinking water, the location where fruits or vegetables are grown in contaminated soil, or the backyard area where someone might breathe contaminated air.

Population
A group of people living in a certain area; or the number of people in a certain area.

PRP
Potentially Responsible Party. A company, government or person that is responsible for causing the pollution at a hazardous waste site. PRP's are expected to help pay for the clean up of a site.

Public Health Assessment(s)
See PHA.

Public Health Hazard
The category is used in PHAs for sites that have certain physical features or evidence of chronic, site-related chemical exposure that could result in adverse health effects.

Public Health Hazard Criteria
PHA categories given to a site which tell whether people could be harmed by conditions present at the site. Each are defined in the Glossary. The categories are:

1. Urgent Public Health Hazard
2. Public Health Hazard
3. Indeterminate Public Health Hazard
4. No Apparent Public Health Hazard
5. No Public Health Hazard

Route of Exposure
The way a chemical can get into a person's body. There are three exposure routes:

- breathing (also called inhalation),
- eating or drinking (also called ingestion), and
- or getting something on the skin (also called dermal contact).

Semivolatile Organic Compound (SVOC)
A chemical compound that partially evaporates or changes from liquid to gas readily at room temperature.

Source (of Contamination)
The place where a chemical comes from, such as a landfill, pond, creek, incinerator, tank, or drum. Contaminant source is the first part of an Exposure Pathway.

Special Populations
People who may be more sensitive to chemical exposures because of certain factors such as age, a disease they already have, occupation, sex, or certain behaviors (like cigarette smoking). Children, pregnant women, and older people are often considered special populations.

Superfund Site
See NPL.

Toxic
Harmful. Any substance or chemical can be toxic at a certain dose (amount). The dose is what determines the potential harm of a chemical and whether it would cause someone to get sick.

Toxicology
The study of the harmful effects of chemicals on humans or animals.

Urgent Public Health Hazard
This category is used in ATSDR's PHA documents for sites that have certain physical features or evidence of short-term (less than 1 year), site-related chemical exposure that could result in adverse health effects and require quick intervention to stop people from being exposed.

Volatile Organic Compound (VOC)
A chemical compound that evaporates (volatilizes) or changes from liquid to gas readily at room temperature.

Appendix B - Tables

<table>
<tr><th colspan="14">Table 1. Environmental Releases in the Area Around the Del Amo Site</th></tr>
<tr><th>Zip Code and Year</th><th>2000</th><th>1999</th><th>1998</th><th>1997</th><th>1996</th><th>1995</th><th>1994</th><th>1993</th><th>1992</th><th>1991</th><th>1990</th><th>1989</th><th>1988</th></tr>
<tr><td rowspan="2">90502*</td><td>29,370</td><td>52,230</td><td>52,912</td><td>62,362</td><td>50,400</td><td>28,851</td><td>10,662</td><td>73,942</td><td>169,658</td><td>534,917</td><td>622,746</td><td>619,609</td><td>468,651</td></tr>
<tr><td colspan="2">Methanol (32-48%), styrene (6-10%), glycol (10-46%), methyl isobutyl ketone (4-7%), toluene (1.7-3%), xylenes (2-31%).</td><td colspan="5">Xylenes (50-60%), toluene (2-25%), styrene (6-23%), glycol (7-53%), methyl isobutyl ketone (3-13%).</td><td>1,1,1-TCA (47%), PCE (40%), BTEX (2%), styrene (3%), and glycol (5%).</td><td>PCE (57%), 1,1,1-TCA (21%), methylene chloride (18%), styrene (2%), and glycol (1%).</td><td colspan="4">1,1,1-TCA (12-50%), methylene chloride (12-38%), PCE (22-42%), MEK (6-13%), BTEX (8-13%), styrene (~2.5%), glycol (1-5%), chromium (<1%), and lead cpds (<1%); caustics(<1%): HF, HNO_3, NaOH, H_2SO_4.</td></tr>
<tr><td rowspan="2">90501</td><td>159</td><td>277</td><td>171</td><td>13,746</td><td>14,989</td><td>19,119</td><td>45,075</td><td>100,724</td><td>136,384</td><td>93,875</td><td>164,681</td><td>97,217</td><td>51,091</td></tr>
<tr><td colspan="3">Similar to 1995-97 but much less quantity and no 1,1,1-TCA.</td><td colspan="3">1,1,1-TCA (1995 only, 62%), n-butyl alcohol (11-24%), naphthalene (16-24%), 1,2,4-trimethylbenzene (start in 1996, 13-15%), and cumene start in 1996, 23-24%), lead (<1%), copper cpds (<1%).</td><td colspan="5">1,1,1-TCA (26-70%), xylenes (8-54%), Freon 113 (1990 only, 14%,), acetone (in 1992 and 1993, 9-12%), copper/cpds (2-7%), lead, HCl, MEK (1991 only, 3%), barium (1991 and 1992 only), chloromethane (1991 and 1992 only, 12%), n-butyl alcohol (start in 1991, 2-9%), naphthalene (start in 1994, 9%), chromium (in 1993 and 1994 only, 1%).</td><td colspan="2">1,1,1-TCA (40-60%), Freon 113 (10-21%), acetone (7-17%), glycol ethers (1-8%), copper (1-3%). Less than 1%: asbestos (1988 only), lead, caustics (HCl, H_2NO_3, H_2PO_4, H_2SO_4). Add HCl in 1989 (23%), propylene (4%), and MEK (2%).</td></tr>
<tr><td rowspan="2">90509#</td><td>1,118,079</td><td>1,920,952</td><td>1,166,936</td><td>971,137</td><td>1,042,806</td><td>794,645</td><td>748,192</td><td>717,326</td><td>604,559</td><td>659,316</td><td>450,966</td><td>528,635</td><td>409,297</td></tr>
<tr><td colspan="5">Ammonia (85-90%). Less than 2%: propylene, BTEX, ethylene, naphthalene, MTBE, n-hexane, phenol, methane, metals (nickel and zinc compounds), HF.</td><td colspan="3"></td><td colspan="3"></td><td colspan="2"></td></tr>
</table>

*** Douglas Aircraft's closure resulted in the large drop in emission release in 1991/1992.**
 # Mobil Refinery is the major industry in this zip code.
1,1,1-TCA=1,1,1-trichloroethane; PCE=tetrachloroethylene; BTEX=benzene, toluene, ethylbenzene, xylenes; HCl=hydrochlororic acid; MEK=methyl ethyl ketone; HF=hydrofluoric acid; MTBE=methyl tertbutyl ether; H_2NO_3=nitric acid; H_2PO_4=phosphoric acid; H_2SO_4=sulfuric acid; NaOH=sodium hydroxide.

Table 2. Evaluation of Exposure Pathways

Location	Pathway Name	Primary Constituents of Concern	Exposure Pathway Elements					Time	Conclusion
			Source	Media	Point of Exposure	Route of Exposure	Potentially Exposed Population		
Developed Area of the Site	Soil exposure	Arsenic, Cadmium, Aroclor1260, Total PCBs, BaP and other carcinogenic PAHs, Benzene, Ethylbenzene	Del Amo, Montrose, and other activities	Soil	Soil	Incidental Ingestion Skin contact	Long-term on site worker Occasional worker Child at daycare	From ~1970s until now Future	Not a public health hazardfrom site-related contaminants
	Exposure to groundwater if it were to be used as drinking water	BTEX	Del Amo, Montrose and several other facilities	Groundwater	Drinking water	Ingestion Inhalation Skin contact	Residents, workers and other users of water	Past Present Future	Eliminated for past and current exposure. Potential in the future if not cleaned up
	Indoor air exposure	BTEX, TCE, Styrene, PCE	Del Amo site activities	Soil gas coming from the contaminated soil and groundwater	Indoor air	Inhalation	Long-term on site worker Occasional worker Child at daycare	From 1970s when development occurred until now Future	Public health hazard for buildings located over LNAPL

Table 2. Evaluation of Exposure Pathways

Location	Pathway Name	Primary Constituents of Concern	Exposure Pathway Elements					Time	Conclusion
			Source	Media	Point of Exposure	Route of Exposure	Potentially Exposed Population		
Waste Pits	Exposure to waste pits contamination before they were capped	PAHs, BTEX, VOCs, SVOCs	Del Amo waste pits	Soil Waste-material	Soil Waste-material	Ingestion Skin contact	Trespasser	Before cap was placed over the pits	Public health hazard - in the past
	Exposure to emissions from waste pits before they were capped	BTEX	Del Amo waste pits	Emissions from waste	Air	Inhalation	Nearby resident Trespasser	Before cap was placed over the pits	Not a public health hazard information
	Exposure to waste pit contamination after cap was placed	PAHs, BTEX, VOCs, SVOCs	Del Amo waste pits	Soil Waste-material	Soil Waste-material	Ingestion Skin contact	Trespasser	After cap was placed over the pits	Not a public health hazard
	Releases from treatment of soil gas captured from under waste pits caps	(Yet to be determined)	Del Amo waste pits soil gas treatment system	Soil gas	To be determined	Inhalation Ingestion Skin contact	Nearby resident	Future - When treatment technology is instituted	Needs to be evaluated when treatment chosen

Table 2. Evaluation of Exposure Pathways									
Location	Pathway Name	Primary Constituents of Concern	Exposure Pathway Elements					Time	Conclusion
			Source	Media	Point of Exposure	Route of Exposure	Potentially Exposed Population		
Neighbor-hood area south of site	Indoor air exposure	BTEX	Del Amo, Montrose and several other facilities	Soil gas coming from contaminated groundwater.	Indoor air	Inhalation	Nearby Residents	Past Present Future	Eliminate rather than completed - a level below public health significance
	Soil exposure before the grading occurred	DDT	Del Amo site	Soil	Surface soil	Ingestion Skin contact	Residents	Past	Eliminated - no chemicals related to Del Amo at levels of health concern.
	Soil exposure after the grading occurred	None	Del Amo site	Soil	Surface soil	Ingestion Skin contact	Trespassers Park workers Park users	Present Future	Eliminated - no chemicals related to Del Amo at levels of health concern

Acronyms used in table: BTEX-benzene, toluene, ethylbenzene, xylenes; DDT- dichlorodiphenyltrichloroethane; PAHs- polycyclic aromatic hydrocarbons; PCBs-polychlorinated biphenyls; SVOCs- semi-volatile organic compounds; BaP- benzo(a)pyrene; PCE- tetrachloroethylene; TCE- trichloroethylene; VOCs- volatile organic compounds

Table 3. Summary of Chemicals of Concerns in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site						
Exposure Area of Potential Concern And Parcel Numbers And Current Building Name	**Surface Soil**	**Sub Surface Soil**	**Shallow Soil Gas**	**Indoor Air (Sampling)**	**Indoor Air (Model)**	**Comments Adequacy of Samples And Historical Uses Described**
#1 7351-31-17	**NS**	**Very few samples composited with other parcels. Cadmium Chromium Manganese**	**NS**	**NS**	**-----**	**Not an area of the facility where manufacturing activity or storage occurred**
#2 7351-31-24 7351-31-25	**Arsenic Cadmium DDT Archlor PCBs PAHs**	**Cadmium DDT Arochlor PCBs PAHs**	**Toluene Xylenes 1,2,3-Trimethylbenzene 1,2,4-Trimethylbenzene 1,3,5-Trimethylbenzene Ethylbenzene Isopropylbenzene Tetrachloroethylene**	**NS**	**Toluene Xylenes 1,2,3-Trimethylbenzene 1,2,4-Trimethylbenzene 1,3,5-Trimethylbenzene Ethylbenzene Isopropylbenzene Tetrachloroethylene**	

Table 3. Summary of Chemicals of Concerns in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site						
Exposure Area of Potential Concern And Parcel Numbers And Current Building Name	**Surface Soil**	**Sub Surface Soil**	**Shallow Soil Gas**	**Indoor Air (Sampling)**	**Indoor Air (Model)**	**Comments Adequacy of Samples And Historical Uses Described**
#3 7351-31-7 Sumitomo	**NS**	**NS**	**3 samples on north end: Benzene Ethylbenzene Toluene**	**Benzene Methylene chloride Tetrachloroethylene Trichloroethylene 1,1-Dichloroethylene 1,1,1-Trichloroethane Cyclohexane Ethylbenzene Methyl ethyl ketone Styrene Toluene Xylenes**	**-----**	**Historically there were tanks located in the area. Building is located over former tank area. Very little sampling.**
#4 7351-31-8	**NS**	**Cadmium Cyclohexane Chromium (Total) Copper 2-Hexanone Manganese Nickel Vandium**	**NS**	**NS**	**-----**	**Not an area of facility where manufacturing activity or storage occurred. No soil gas data. A little soil data.**

Table 3. Summary of Chemicals of Concerns in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site						
Exposure Area of Potential Concern And Parcel Numbers And Current Building Name	**Surface Soil**	**Sub Surface Soil**	**Shallow Soil Gas**	**Indoor Air (Sampling)**	**Indoor Air (Model)**	**Comments Adequacy of Samples And Historical Uses Described**
#5 7351-33-17 WRC (Toyota-leases)	**NS**	**NS**	**Benzene Toluene Dichlorobromomethane 2-Hexanone 1,2,3-Trimethylbenzene Methyl isobutyl ketone Xylenes Ethylbenzene Tetrachloroethylene Trichloroethylene**	**Benzene Methylene Chloride Tetrachloroethylene Trichloroethylene Toluene**	**-----**	**Lots of manufacturing of butadiene during facility operation. Fair amount of data but no metal analyses.**
#6 7351-33-22 Hamilton Dutch Building	**NS**	**NS**	**Benzene Toluene Ethylbenzene Xylenes**	**NS**	**Benzene Toluene Ethylbenzene Xylenes**	**Historical usage occurred in area. Non RI/FS sampling. Lots of soil gas sampling. Most samples analyzed for BTEX, very little other VOC analysis or bad detection limits.**

Table 3. Summary of Chemicals of Concerns in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site						
Exposure Area of Potential Concern And Parcel Numbers And Current Building Name	**Surface Soil**	**Sub Surface Soil**	**Shallow Soil Gas**	**Indoor Air (Sampling)**	**Indoor Air (Model)**	**Comments Adequacy of Samples And Historical Uses Described**
#7 7351-33-26	NS	NS	Benzene Cyclohexane	-----	Benzene Chloromethane Cyclohexane Freon 12 Freon 114	Storage tanks and pipelines on property when facility was in operation. NAPL present in area. High detection limits for soil gas - bad data
#8 7351-33-27 Takechi USA Inc.	NS	For VOCs only No COCs	Benzene Cyclohexane 2-Hexanone	Benzene Tetrachloroethylene Toluene Styrene Xylenes Cyclohexane Methyl ethyl ketone 1,1-Dichloroethane 1,1-TCA Ethylbenzene	-----	Storage tanks and pipelines on property when facility was in operation. NAPL present in area.

Table 3. Summary of Chemicals of Concerns in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site

Exposure Area of Potential Concern And Parcel Numbers And Current Building Name	Surface Soil	Sub Surface Soil	Shallow Soil Gas	Indoor Air (Sampling)	Indoor Air (Model)	Comments Adequacy of Samples And Historical Uses Described
#9 7351-33–30 Currently Undeveloped	1 Sample which was a composite of 6 samples: Arsenic Cadmium Chromium Copper Manganese Vanadium Nickel DDT	NS	NS	NA	-----	Butadiene plant or fabrication plant located in this area. Also had cooling towers located in the area.

Table 3. Summary of Chemicals of Concerns in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site						
Exposure Area of Potential Concern And Parcel Numbers And Current Building Name	**Surface Soil**	**Sub Surface Soil**	**Shallow Soil Gas**	**Indoor Air (Sampling)**	**Indoor Air (Model)**	**Comments Adequacy of Samples And Historical Uses Described**
#10 7351-33-34 Currently Undeveloped	2 Composite samples - composite from this parcel and two other parcels: Arsenic Cadmium Chromium (Total) Copper Manganese Nickel Vanadium Zinc DDT Dieldrin	NS	Benzene Toluene Tetrachloroethylene	NA	Benzene Tetrachloroethylene Toluene	Pipelines run across the property.

Table 3. Summary of Chemicals of Concerns in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site						
Exposure Area of Potential Concern And Parcel Numbers And Current Building Name	**Surface Soil**	**Sub Surface Soil**	**Shallow Soil Gas**	**Indoor Air (Sampling)**	**Indoor Air (Model)**	**Comments Adequacy of Samples And Historical Uses Described**
#11 7351-33-37 Currently Undeveloped	2 Composites, one composite shared with other parcels: Arsenic Cadmium Chromium Copper Manganese Nickel Vanadium Zinc Dieldrin DDT	NS	Benzene Tetrachloroethylene 1,2,4-Trimethylbenzene	NA	Benzene Tetrachloroethylene 1,2,4-Trimethylbenzene	Butadiene plant used to be located on the parcel. Cooling towers located in parcel. High detection limits for BTEX in soil gas. Not much other VOC analyses.

Table 3. Summary of Chemicals of Concerns in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site

Exposure Area of Potential Concern And Parcel Numbers And Current Building Name	Surface Soil	Sub Surface Soil	Shallow Soil Gas	Indoor Air (Sampling)	Indoor Air (Model)	Comments Adequacy of Samples And Historical Uses Described
#12 7351-33-40 Currently Undeveloped	2 Composted samples - shared with other parcels: Arsenic Cadmium Chromium (Total) Copper Manganese Nickel Vanadium Zinc Dieldrin DDT	NS	2 Samples Benzene	NA	Benzene	Historical use did not seem to involve hazardous material. Pipelines crossed parcel. High detection limits for BTEX in soil gas.
#13 7351-33-900 Gas/Utility Right-of-Way	NS	NS	NS	NA	NA	Historically it was also a Department of Water and Power right-of-way. So no facility activities in area.

Table 3. Summary of Chemicals of Concerns in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site						
Exposure Area of Potential Concern And Parcel Numbers And Current Building Name	**Surface Soil**	**Sub Surface Soil**	**Shallow Soil Gas**	**Indoor Air (Sampling)**	**Indoor Air (Model)**	**Comments Adequacy of Samples And Historical Uses Described**
#14 7351-34-39 Miller Fabrication	**NS**	**NS**	**Benzene 4-Ethyl toluene Cyclohexane Xylenes Ethylbenzene Styrene Tetrachloroethylene**	**Benzene 1,1,1-Trichoroethane Ethylbenzene Methyl ethyl ketone Styrene Tetrachloroethylene Toluene Trichloroethylene Xylenes**	**-----**	**Historically, pipelines ran across the property. High detection limits in soil gas.**
#15 7351-34-41 Obie Formerly F. Schaefer Publications	**NS**	**NS**	**Benzene Ethylbenzene Tetrachloroethylene Xylenes Toluene**	**Benzene Ethylbenzene Styrene Tetrachloroethylene Toluene Xylenes**	**-----**	**Historically, pipelines ran across the property and a styrene finishing unit was located there.**

Table 3. Summary of Chemicals of Concerns in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site						
Exposure Area of Potential Concern And Parcel Numbers And Current Building Name	**Surface Soil**	**Sub Surface Soil**	**Shallow Soil Gas**	**Indoor Air (Sampling)**	**Indoor Air (Model)**	**Comments Adequacy of Samples And Historical Uses Described**
#16 7351-34-43 Ace	**NS**	**NS**	**Tetrachloroethylene 1,1,1-Trichloroethane Freon 11**	**1,1,1-Trichloroethane Benzene Chloroform Ethylbenzene Methyl ethyl ketone Styrene Tetrachloroethylene Toluene Xylenes**	**Tetrachloroethylene 1,1,1-Trichloroethane Freon 11**	**Historically, pipelines ran across the parcel. Limited soil gas sampling.**
#17 7351-34-45	**NS**	**NS**	**Tetrachloroethylene 1,1,1-Trichloroethane 1,1-Dichloroethylene Freon 11 Acetone**	**NS**	**Tetrachloroethylene 1,1,1-Trichloroethane 1,1-Dichloroethylene Freon 11 Acetone**	**Historically, pipelines ran across the parcel. Limited soil gas sampling.**

Table 3. Summary of Chemicals of Concerns in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site						
Exposure Area of Potential Concern And Parcel Numbers And Current Building Name	**Surface Soil**	**Sub Surface Soil**	**Shallow Soil Gas**	**Indoor Air (Sampling)**	**Indoor Air (Model)**	**Comments Adequacy of Samples And Historical Uses Described**
#18 7351-34-47 R. R. Donnelly Financial	NS	NS	Ethylbenzene Toluene Tetrachloroethylene Benzene 1,1,1-Trichloroethane	Benzene 1,1,1-Trichloroethane Cyclohexane Ethylbenzene Methyl ethyl ketone Methylene chloride Styrene Tetrachloroethylene Xylenes	-----	When facility was in operation, manufacturing activities like ethylbenzene production took place on the parcel. High detection limits for soil gas samples.

Table 3. Summary of Chemicals of Concerns in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site						
Exposure Area of Potential Concern And Parcel Numbers And Current Building Name	**Surface Soil**	**Sub Surface Soil**	**Shallow Soil Gas**	**Indoor Air (Sampling)**	**Indoor Air (Model)**	**Comments Adequacy of Samples And Historical Uses Described**
#19 **7351-34-72**	**NS**	**1 single sample** **2 composited samples with other parcels** **Cadmium** **Chromium (total)** **Copper** **Manganese** **Nickel** **Vanadium** **Zinc**	**Tetrachloroethylene**	**NS**	**Tetrachloroethylene**	**Historically, pipelines ran across the parcel.**

Table 3. Summary of Chemicals of Concerns in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site						
Exposure Area of Potential Concern And Parcel Numbers And Current Building Name	**Surface Soil**	**Sub Surface Soil**	**Shallow Soil Gas**	**Indoor Air (Sampling)**	**Indoor Air (Model)**	**Comments Adequacy of Samples And Historical Uses Described**
#20 7351-34-15 7351-34-50 7351-34-56 R. R. Donelly & Sons	**NS**	**Arsenic Manganese Cadmium Chromium (total) N-Nitroso-dipenylamine**	**Ethylbenzene Styrene 1,4-Dichlorobenzene 1,3,5-Trimethylbenzene Toluene Tetrachloroethylene 2-Hexanone 4-Ethyl toluene Chloroform Benzene 1,1,1-Trichloroethane Trichloroethylene 1,2,4-Trimethylbenzene**	**1,1,1-Trichloroethane Benzene Chlorobenzene Cyclohexane Ethylbenzene Methyl ethyl ketone Styrene Tetrachloroethylene Toluene Trichloroethylene Xylenes**	**Ethylbenzene Styrene 1,4-Dichlorobenzene 1,3,5-Trimethylbenzene Toluene Tetrachloroethylene 2-Hexanone 4-Ethyl toluene Chloroform Benzene 1,1,1-Trichloroethane Trichloroethylene 1,2,4-Trimethylbenzene**	**Benzene, toluene and other tanks were located in one parcel. NAPL present in area.**

Table 3. Summary of Chemicals of Concerns in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site						
Exposure Area of Potential Concern And Parcel Numbers And Current Building Name	**Surface Soil**	**Sub Surface Soil**	**Shallow Soil Gas**	**Indoor Air (Sampling)**	**Indoor Air (Model)**	**Comments Adequacy of Samples And Historical Uses Described**
#21 7351-34-52 Toyota	**NS**	**NS**	**Tetrachloroethylene Benzene 4-Ethyl toluene Trichloroethylene 1,2,4-Trimethylbenzene**	**1,1,1-Trichloroethane Benzene Cyclohexane Ethylbenzene Methyl ethyl ketone Methylene chloride Styrene Tetrachloroethylene Toluene Trichloroethylene Xylenes**	**Tetrachloroethylene Benzene 4-Ethyl toluene Trichloroethylene 1,2,4-Trimethylbenzene**	**When the facility was in operation, manufacturing activities like ethylbenzene production took place on the parcel. High detection limits for the soil gas sampling.**

Table 3. Summary of Chemicals of Concerns in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site						
Exposure Area of Potential Concern And Parcel Numbers And Current Building Name	**Surface Soil**	**Sub Surface Soil**	**Shallow Soil Gas**	**Indoor Air (Sampling)**	**Indoor Air (Model)**	**Comments Adequacy of Samples And Historical Uses Described**
#22 7351-34-57 Coca Cola Building	NS	Limited sampling Benzene Ethylbenzene (no metals analysis)	Ethylbenzene Styrene 1,3,5-Trimethylbenzene Toluene Tetrachloroethylene Xylenes 2-Hexanone 4-Ethyl toluene Acetone Chloroform Benzene 1,1,1-Trichloroethane Trichloroethylene 1,2,4-Trimethylbenzene 1,2-Dichloroethane	Benzene (only analyzed for benzene, ethylbenzene, styrene, and toluene)	Ethylbenzene Styrene 1,3,5-Trimethylbenzene Toluene Tetrachloroethylene Xylenes 2-Hexanone 4-Ethyl toluene Acetone Chloroform Benzene 1,1,1-Trichloroethane Trichloroethylene 1,2,4-Trimethylbenzene 1,2-Dichloroethane	Several storage areas for styrene benzene, ethylbenzene and toluene were located here.
#23 7351-34-58	NS	Limited sampling one boring - two depths No metals No COCs	Ethylbenzene 1,3,5-Trimethylbenzene Tetrachloroethylene 4-Ethyl toluene Benzene Trichloroethylene 1,2,4-Trimethylbenzene	NS	Ethylbenzene 1,3,5-Trimethylbenzene Tetrachloroethylene 4-Ethyl toluene Benzene Trichloroethylene 1,2,4-Trimethylbenzene	Storage tanks were located on this parcel.

Table 3. Summary of Chemicals of Concerns in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site						
Exposure Area of Potential Concern And Parcel Numbers And Current Building Name	**Surface Soil**	**Sub Surface Soil**	**Shallow Soil Gas**	**Indoor Air (Sampling)**	**Indoor Air (Model)**	**Comments Adequacy of Samples And Historical Uses Described**
#24 7351-34-69 Tri-Lite	**NS**	**Nickel Chromium (total) Vanadium Arsenic**	**Ethylbenzene Styrene Xylenes Toluene Cyclohexane Tetrachloroethylene sec-Butyl benzene 4-Ethyl toluene Benzene 1,1,1-Trichloroethane Freon 114 Isopropyl benzene**	**1,1,1-Trichloroethane Benzene Chloroform Cyclohexane Ethylbenzene Methyl ethyl ketone Methylene chloride Styrene Tetrachloroethylene Toluene Trichloroethylene Xylenes**	**Ethylbenzene Styrene Xylenes Toluene Cyclohexane Tetrachloroethylene sec-Butyl benzene 4-Ethyl toluene Benzene 1,1,1-Trichloroethane Freon 114 Isopropyl benzene**	**Historically, pipeline ran across the property and a styrene finishing unit was located there. Lots of soil sampling conducted outside RI/FS for VOCs, primarily.**
#25 7351-34-70	**2 composites shared with another parcel Arsenic Chromium (total) Cadmium Manganese Nickel DDT Benzo(a)anthracene Phenanthrene**	**Arsenic Chromium (total) Cadmium Nickel Manganese DDT**	**No COCs**	**NA**	**NA**	**A storage area was located in the eastern portion when facility was in operation. Unlikely to ever be developed. High detection limits for the soil gas.**

Table 3. Summary of Chemicals of Concerns in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site						
Exposure Area of Potential Concern And Parcel Numbers And Current Building Name	**Surface Soil**	**Sub Surface Soil**	**Shallow Soil Gas**	**Indoor Air (Sampling)**	**Indoor Air (Model)**	**Comments Adequacy of Samples And Historical Uses Described**
#26 7351-34-73	**NS**	**NS**	**Limited - three samples Ethylbenzene Styrene Toluene Cyclohexane Xylenes Benzene**	**NS**	**Ethylbenzene Styrene Toluene Cyclohexane Xylenes Benzene**	**Not much activity or storage on the parcel when facility was in operation. High detection limits for soil gas.**
#27 7351-34-901	**2 composites shared with another parcel Arsenic Cadmium Chromium (total) Manganese Nickel Vanadium DDT Phenanthrene Acenaphthylene Benzo(a)anthracene 2-Methylnaphthalene**	**Arsenic Cadmium Chromium (total) Manganese Nickel Vanadium**	**No COCs**	**NA**	**Benzene Ethylbenzene Toluene Xylenes**	**Historically, as it is now, it was a Department of Water & Power Right of Way.**

Table 3. Summary of Chemicals of Concerns in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site						
Exposure Area of Potential Concern And Parcel Numbers And Current Building Name	**Surface Soil**	**Sub Surface Soil**	**Shallow Soil Gas**	**Indoor Air (Sampling)**	**Indoor Air (Model)**	**Comments Adequacy of Samples And Historical Uses Described**
#28 **Pacific Gateway**	**NS**	**2 samples for VOCs, SVOCs** **2 samples composited with other parcels - for PCBs / pesticides and metals** **Manganese** **Nickel** **Cadmium** **Chromium**	**Ethylbenzene** **Styrene** **1,3,5-Trimethylbenzene** **Toluene** **Tetrachloroethylene** **Xylenes** **4-Ethyl toluene** **Acetone** **Chloroform** **Benzene** **1,1,1-Trichloroethane** **Freon 11** **Freon 12** **Trichloroethylene**	**NA**	**NA**	**A street. Pipelines have crossed the property in the past.**
#29 **Magellan Drive**	**NS**	**NS**	**Ethylbenzene** **Toluene** **Tetrachloroethylene** **Benzene**	**NA**	**NA**	**A street. Pipelines cross the parcel.**

Table 3. Summary of Chemicals of Concerns in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site						
Exposure Area of Potential Concern And Parcel Numbers And Current Building Name	Surface Soil	Sub Surface Soil	Shallow Soil Gas	Indoor Air (Sampling)	Indoor Air (Model)	Comments Adequacy of Samples And Historical Uses Described
#31 7351-31-18	NS	Limited sampling Cadmium Manganese Chromium (total)	1,4-Dichlorobenzene 1,3,5-Trimethylbenzene Tetrachloroethylene 4-Ethyl toluene Freon 11 Freon 12 Trichloroethylene 1,2,4-Trimethylbenzene	NS	1,4-Dichlorobenzene 1,3,5-Trimethylbenzene Tetrachloroethylene 4-Ethyl toluene Freon 11 Freon 12 Trichloroethylene 1,2,4-Trimethylbenzene	Historically, there was a reactor building for synthetic rubber located on the parcel.
#31 7351-34-54	NS	Cadmium Manganese	No COCs	NS	-----	Not much activity on property. Pipeline crossed some parts of the property.
# 7351-34-66 Nippon Express	1 Surface soil for SVOC, PCBs / pesticides No COCs/No EDB	NS	5 shallow soil gas - four without complete VOC analysis Carbon tetrachloride Chloroform	Benzene Cyclohexane Ethylbenzene Methyl ethyl ketone Methylene chloride Styrene Toluene 1,1,1-Trichloroethane Xylenes	-----	Eastern Research Company was located in this parcel.

Table 3. Summary of Chemicals of Concerns in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site						
Exposure Area of Potential Concern And Parcel Numbers And Current Building Name	**Surface Soil**	**Sub Surface Soil**	**Shallow Soil Gas**	**Indoor Air (Sampling)**	**Indoor Air (Model)**	**Comments Adequacy of Samples And Historical Uses Described**
#33 7351-31-20 LAX Business Center	NS	NS	2 shallow soil gas - only one had complete VOC analysis No COCs	Benzene Cyclohexane Ethylbenzene Methyl ethyl ketone Methylene chloride Styrene Tetrachloroethylene 1,1,1-Trichloroethane Xylenes	-----	Laboratory and process building for synthetic rubber process were located in this area.

Table 3. Summary of Chemicals of Concerns in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site						
Exposure Area of Potential Concern And Parcel Numbers And Current Building Name	**Surface Soil**	**Sub Surface Soil**	**Shallow Soil Gas**	**Indoor Air (Sampling)**	**Indoor Air (Model)**	**Comments Adequacy of Samples And Historical Uses Described**
7351-31-800 7351-33-15 7351-33-20 7351-33-39 7351-34-21 7351-34-23 7351-34-24 7351-34-75 7351-34-64 7351-34-76 7351-34-67 7351-34-68	NS	NS	Tetrachloroethylene Freon113 1,1,1-Trichloroethane 1,1-Dichloroethylene Acetone Chloroform Dichlorobromomethane Freon 11 Ethylbenzene 1,3,5-Trimethylbenzene Toluene Cyclohexane 4-Ethyl toluene Benzene 1,2,4-Trimethylbenzene	NS	-----	Pipeline crossed these properties. Cooling towers located in 7351-33-20 and 7351-33-39.
7351-34-65	NS	NS	5 shallow soil gas samples - four without complete VOC analysis Freon 11 Freon 113	NS	-----	Some historical usage.

Table 3. Summary of Chemicals of Concerns in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site						
Exposure Area of Potential Concern And Parcel Numbers And Current Building Name	**Surface Soil**	**Sub Surface Soil**	**Shallow Soil Gas**	**Indoor Air (Sampling)**	**Indoor Air (Model)**	**Comments Adequacy of Samples And Historical Uses Described**
7351-33-9	NS	NS	12 shallow soil gas - two with complete VOC analysis 1,3,5-Trimethylbenzene Tetrachloroethylene 4-Ethyl toluene Chloroform Benzene Acetonitrile Trichloroethylene 1,2,4-Trimethylbenzene	NS	-----	Unlined impoundments were located on this parcel.
7351-33-24 7351-33-23	NS	NS	1,4-Dichlorobenzene 1,3,5-Trimethylbenzene 4-Ethyl toluene Chloroform Benzene Chloromethane Chloroethane Acetonitrile 1,2,4-Trimethylbenzene	NS	-----	Wastewater treatment, oil skimmer and other recovery operations occurred here.

Table 3. Summary of Chemicals of Concerns in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site						
Exposure Area of Potential Concern And Parcel Numbers And Current Building Name	**Surface Soil**	**Sub Surface Soil**	**Shallow Soil Gas**	**Indoor Air (Sampling)**	**Indoor Air (Model)**	**Comments Adequacy of Samples And Historical Uses Described**
7351-34-74	NS	NS	3 shallow - only one with complete VOC analysis 2-Hexanone 4-Ethyl toluene Benzene 1,1,1-Trichloroethane 1,2,4-Trimethylbenzene	NS	NS	Something historical located here.

Information was obtained from the Baseline risk assessment report (draft) for the Del Amo site (28)
Aconyms used in table: DDT- dichlorodiphenyltrichloroethane; PAHs- polycyclic aromatic hydrocarbons; PCBs- polychlorinated biphenyls; VOCs- volatile organic compounds; NS- not sampled; COCs- chemicals of concern

Table 4. Summary of Surface and Shallow Soil Data Collected from the Developed Portion of the Del Amo Site All Units (ppm)						
Type of Chemical	Chemical	Surface Soil (0- 6 Inches Bgs)		Shallow Soil (6 Inches to 3 Feet Bgs)		Health Comparison Value (Source); Background Range for Metal (Average Background Concentration)
		# of Hits/ # of Samples	Range of Concentration (Average)	# of Hits/ # of Samples	Range of Concentration (Average)	
Metal	Arsenic	53/53	2.6-49 (10.7)	126/129	1-49 (6.0)	20 (Child Chronic EMEG) 0.5 (CREG) Bkgd=0.6-11 (3.5)
Metal	Barium	5353	130-210 (163)	128/128	79.8-210 (138)	4,000 (Child RMEG) Bkgd=133-1,400 (509)
Metal	Cadmium	5353	6.3-9.1 (6.9)	101/127	1.3-17 (7.8)	10 (Child EMEG) Bkgd=0.05-1.7 (0.36)
Metal	Chromium	53/53	18-290 (30.8)	128/128	12-290 (24.7)	80,000 (Child RMEG) Bkgd=23-1,579 (122)
Metal	Cobalt	53/53	8.8-12 (10)	128/128	6-15 (9.8)	500 (Child Intermediate EMEG) Bkgd=2.7-46.9 (14.9)
Metal	Copper	53/53	19-240 (60.9)	128/128	6.5-240 (36.9)	2,900 (Residential PRG) Bkgd=9.1-96.4 (28.7)
Metal	Manganese	53/53	310-620 (456)	98/98	270-620 (434)	3,000 (Child RMEG) Bkgd=253-1,687 (646)
Metal	Nickel	53/53	12-59 (19.6)	128/128	7-62.5 (16)	1,000 (Child RMEG) Bkgd=9-509 (57)
Metal	Lead	53/53	5.6-200 (36.5)	119/128	4.2-240 (22)	400 (Residential PRG) Bkgd=12.4-97.1 (23.9)

Table 4. Summary of Surface and Shallow Soil Data Collected from the Developed Portion of the Del Amo Site All Units (ppm)						
Type of Chemical	Chemical	Surface Soil (0- 6 Inches Bgs)		Shallow Soil (6 Inches to 3 Feet Bgs)		Health Comparison Value (Source); Background Range for Metal (Average Background Concentration)
		# of Hits/ # of Samples	Range of Concentration (Average)	# of Hits/ # of Samples	Range of Concentration (Average)	
Metal	Vanadium	53/53	36-160 (49.6)	128/128	23.2-160 (42)	200 (Child Intermediate EMEG) Bkgd=39-288 (112)
Metal	Zinc	53/53	56-650 (101)	128/128	28-650 (41.8)	20,000 (Child Chronic EMEG) Bkgd=88-236 (149)
Pesticide	4,4'-DDD	42/53	0.0043-2.7 (0.26)	43/106	<1-2.7 (0.13)	30 (Child RMEG)
Pesticide	4,4'-DDE	46/53	0.0056-2.2 (0.36)	48/106	<1-2.2 (0.18)	30 (Child RMEG)
Pesticide	4,4'-DDT	52/53	0.022-9.1 (1.5)	54/106	<0.1-9.1 (0.76)	1.0 (CREG)
Pesticide	Aroclor 1260	3/53	0.25-6.8	7/117	<30-6.8	0.22 (CREG)
Pesticide	Aroclor 1262	NA	NA	14/21	<0.1-0.09	
Pesticide	Dieldrin	14/53	<2-0.01	3/106	<2-0.001	3 (Child Chronic EMEG) 0.04 (CREG)
Pesticide	Total PCB's	3/53	0.25-6.8	3/97	<30-6.8	0.04 (CREG)
SVOC	2-Methylnaphthalene	3/53	<0.4-0.25	3/94	<80-0.25	-
SVOC	Acenaphthene	353	<0.4-0.23	3/94	<40-0.23	3,000 (Child RMEG)
SVOC	Acenaphthylene	3/53	<O.4-0.47	3/94	<40-0.47	-
SVOC	Anthracene	3/53	<0.4-0.57	3/94	<40-0.57	20,000 (Child RMEG)
SVOC	Benzo(a)anthracene	7/53	<0.4-0.31	7/94	<40-1.1	0.01 (BAP-eq CREG)

Table 4. Summary of Surface and Shallow Soil Data Collected from the Developed Portion of the Del Amo Site

All Units (ppm)

Type of Chemical	Chemical	Surface Soil (0- 6 Inches Bgs)		Shallow Soil (6 Inches to 3 Feet Bgs)		Health Comparison Value (Source); Background Range for Metal (Average Background Concentration)
		# of Hits/ # of Samples	Range of Concentration (Average)	# of Hits/ # of Samples	Range of Concentration (Average)	
SVOC	Benzo(a)pyrene	3/53	<0.4-0.43	3/94	<40-0.43	0.1 (CREG)
SVOC	Benzo(b)fluoranthene	3/53	<0.4-0.87	3/94	<40-0.87	0.01 (BAP-eq CREG)
SVOC	Benzoic acid	1/53	<2-9.3	1/93	<400-9.3	200,000 (Child RMEG)
SVOC	Bis(2-ethylhexyl)phthalate	8/53	<0.3-0.77	8/94	<80-3.1	35 (Residential PRG)
SVOC	Butylbenzylphthalate	7/53	<0.4-0.34	7/94	<40-0.65	10,000 (Child RMEG)
SVOC	Chrysene	3/53	<0.4-1.1	3/94	<80-1.1	10 (BAP-eq CREG)
SVOC	Di-n-butylphthalate	1/53	<0.4-8.3	2/94	<80-8.3	6,100 (Residential PRG)
SVOC	Fluoranthene	10/53	<0.4-0.24	10/94	<40-1.6	2,000 (Child RMEG)
SVOC	Fluorene	0/53	<0.4-0.24	3/94	<40-0.24	2,000 (Child RMEG)
SVOC	N-Nitrosodiphenylamine	0/53	<0.4	1/94	<10-280	100 (CREG)
SVOC	Naphthalene	0/53	<0.4	0/94	<80	1,000 (Child RMEG)
SVOC	Phenanthrene	11/53	<0.2-1	12/94	<40-2.6	-
SVOC	Pyrene	17/53	<0.2-0.21	18/94	<40-3.4	2,000 (Child RMEG)
VOC	1,2,4-Trimethylbenzene	0/5	<0.005	4/69	<1-76	52 (Residential PRG)
VOC	1,2-Dichlorobenzene	0/5	<0.4	1/106	<80-0.071	5,000 (Child RMEG)
VOC	1,3,5-Trimethylbenzene	0/5	<0.005	2/69	<3-1.18	21 (Residential PRG)

Table 4. Summary of Surface and Shallow Soil Data Collected from the Developed Portion of the Del Amo Site All Units (ppm)						
Type of Chemical	Chemical	Surface Soil (0- 6 Inches Bgs)		Shallow Soil (6 Inches to 3 Feet Bgs)		Health Comparison Value (Source); Background Range for Metal (Average Background Concentration)
		# of Hits/ # of Samples	Range of Concentration (Average)	# of Hits/ # of Samples	Range of Concentration (Average)	
VOC	1,4-Dichlorobenzene	0/5	<0.4	1/106	<80-0.021	20,000 (Child Intermediate EMEG)
VOC	2-Hexanone	0/5	<0.05	1/105	<2,000-45	-
VOC	Acetone	0/5	<0.05	1/104	<8,000-0.094	5,000 (Child RMEG)
VOC	Benzene	0/5	<0.05	17/126	<400-300	10 (CREG)
VOC	Cyclohexane	0/1	<0.001	3/39	<10-110	140 (Residential PRG)
VOC	Ethyl benzene	0/5	<0.005	20/127	<5-12,000	5,000 (Child RMEG)
VOC	Methyl isobutyl ketone (MIBK)	0/5	<0.05	1/104	<2,000-24	790 (Residential PRG)
VOC	Methylene chloride	0/5	<0.05	1/110	<400-0.0096	3,000 (Child Chronic EMEG) 90 (CREG)
VOC	Naphthalene	0/5	<0.4	7/75	<80-0.095	1,000 (Child RMEG)
VOC	Styrene	0/5	<0.005	3/107	<100-15,000	10,000 (Child RMEG)
VOC	Tetrachloroethene	1/5	<0.005-0.006	9/110	<400-0.097	500 (Child RMEG) / 5.7 (Residential PRG)
VOC	Toluene	0/5	<0.005	8/127	<400-18	10,000 (Child RMEG)
VOC	Xylenes (Total)	NA	NA	2/63	<400-22	100,000 (Child RMEG)

Table 4. Summary of Surface and Shallow Soil Data Collected from the Developed Portion of the Del Amo Site

All Units (ppm)

Type of Chemical	Chemical	Surface Soil (0- 6 Inches Bgs)		Shallow Soil (6 Inches to 3 Feet Bgs)		Health Comparison Value (Source); Background Range for Metal (Average Background Concentration)
		# of Hits/ # of Samples	Range of Concentration (Average)	# of Hits/ # of Samples	Range of Concentration (Average)	
VOC	m,p-Xylene	0/5	<0.01	4/62	<0.2-1.1	30,000 (Child Intermediate EMEG)
VOC	n-Butylbenzene	1/5	<0.005-0.005	12/62	<0.1-27	140 (Residential PRG)
VOC	n-Propylbenzene	0/5	<0.005	2/69	<3-1.7	140 (Residential PRG)
VOC	o-Xylene	0/5	<0.005	2/62	<0.1-0.015	-
VOC	p-Isopropyltoluene	0/5	<0.005	1/62	<0.1-0.009	-
VOC	sec-Butylbenzene	0/5	<0.005	10/69	<3-51	110 (Residential PRG)
VOC	tert-Butylbenzene	0/5	<0.05	1/69	<3-0.002	130 (Residential PRG)

Data obtained from Section 2, Pilot feasibility study, summary of RI/FS investigation and findings (4). Background metal concentrations were obtained from "Background concentrations of trace and major elements in California soils" (31).
Acronyms used in table: ppm- parts per million; RMEG- Reference Dose Media Evaluation Guide; EMEG- Environmental Media Evaluation Guide; PRG- preliminary remediation goal; bgs- below ground surface; VOC- volatile organic compound; CREG- Cancer Risk Evalaution Guideline; SVOC- semi-volatile organic compound; BaP-eq- benzo(a)pyrene equivalent.

Table 5. Summary of the Health Evaluation from Exposure to the Soil on the Developed Portion of the Site

Potentially Exposed Group		Non-Cancer	Cancer
Long-term worker who works digs in surface soil	Maximum Soil Concentration	None expected	4.4 in 100,000 Very low increased risk
	Average Soil Concentration	None expected	7.6 in 1,000,000 No apparent increased risk
Occasional worker who digs into the subsurface soil	Maximum Soil Concentration	None expected	2.8 in 1,000,000 No apparent increased risk
	Average Soil Concentration	None expected	6.4 in 10,000,000 No apparent increased risk
Child attending daycare who plays on surface soil	Maximum Soil Concentration	Arsenic exposure estimate exceeds health comparison value	------
	Average Soil Concentration	None expected	-----

Doses were calculated from the following information: maximum and average surface soil concentrations from Table 4 for the long-term worker and the child attending daycare. Highest concentration (maximum and average) from the surface or subsurface soil concentrations listed in Table 4 for the short-term worker. Long-term and occasional (short-term) worker weight: 70 kilograms (154 pounds). Child weight (13.5 kilograms or 30 pounds) was derived from the average of the 50th percentile of boys and girls ages 6 months to 5 years from the USEPA's Exposure Factors Handbook (44). The following were th times assumed for exposure duration: 250 days per year for 25 years for the long-term worker; 14 days per year for 25 years for the short-term worker and 250 days per year for 4.5 years for the child attending day-care. Incidental ingestion was assumed to be 100 micrograms soil per day for both worker populations and 200 micrograms per day for the child.

Table 6. Summary of Chemicals Detected Near the Del Amo Site and the Groundwater Units in which Each Chemical was Detected						
Compounds	**Upper Bell-flower Aquitard**	**Middle Bell-flower B-sand Benzene Plume**	**Bell-flower C-sand**		**Gage Aquifer**	**Lynwood Aquifer**
			Benzene Plume	**Chloro-benzene Plume**		
Acetone	X		X	X	X	
Total DDT	X		X	X	X	
Total BHC	X		X	X		
sec-Butylbenzene		X				
Benzene	X	X	X	X	X	X
Carbon disulfide		X				
Carbon tetrachloride	X					
Chlorobenzene	X	X	X	X	X	X
Chloroform	X	X	X	X	X	
Dibromochloromethane		X				
1,2-Dichlorobenzene			X	X	X	
1,4-Dichlorobenzene			X	X	X	
1,1-Dichloroethane		X				
1,2-Dichloroethane	X	X	X	X	X	
1,1-Dichloroethylene		X				
cis 1,2-Dichloroethylene		X				
Ethylbenzene	X	X	X	X	X	
Methylene chloride	X	X				
Naphthalene		X				
Styrene		X				
Tetrachloroethylene	X	X	X	X	X	
Toluene	X	X	X	X	X	
Trichloroethylene	X	X	X	X		
1,2,4-Trimethylbenzene		X				
1,3,5-Trimethylbenzene		X				
Vinyl chloride		X				
Total Xylenes	X	X	X	X		
Arsenic		X				
Manganese		X				

Information obtained from Groundwater remedial investigation report (final), Del Amo study area (2)
DDT- dichlorodiphenyltrichloroethane; BHC- benzene hydrochloride

Table 7. California Department of Health Services Monitoring Frequency Guideline for Organic and Inorganic Chemicals in the West Basin Area	
Parameters to be Sampled (Chemicals included in this analysis that are found in groundwater contamination near Del Amo and Montrose)	**Frequency of Monitoring**
VOCs that are regulated under Title 22 (Benzene, carbon tetrachloride, chlorobenzene, chloroform, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 1,-dichloroethane, 1,2-dichloroethane, 1,1-dichloroethylene, cis-1,2-dichloroethylene, ethyl benzene, methylene chloride, styrene, tetrachloroethylene, toluene, trichloroethylene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, vinyl chloride, xylenes)	**VOCs, annually if none detected; Quarterly if "hits" are detected but less than MCLs; or Monthly if "hits" are greater than MCLs.**
SVOCs that are regulated under Title 22	**SVOCs every five years if none detected; Quarterly if "hits" are detected but less than MCLs; or Monthly if "hits" are greater than MCLs.**
Organic chemicals that are unregulated but monitoring is required	**Naphthalene- monitored as required federal govt. 1987-1999 1,2,4-Trimethylbenzene 1,3,5-Trimethylbenzene sec-Butylbenzene BHC**
Inorganic chemicals that are regulated under Title 22 (arsenic, manganese)	**Once every 3 years**

VOCs- volatile organic compound
SVOCs- semivolatile organic compounds
MCL- Maximum Contaminant Level

Table 8. Summary of Shallow Soil Gas Data Collected on the Developed Portion of the Del Amo Site
All Units µg/m³

Chemical	Number Of Samples	Number Of Hits	Frequency Of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Mean Concentration
1,1,1-Trichloroethane	613	91	15	9.247	7,104	528.4
1,1,2,2-Tetrachloroethane	75	2	3	7.558	22.67	7,576
1,1-Dichloroethane	403	1	0	113.4	113.4	768.4
1,1-Dichloroethylene	612	6	1	3.488	6,103	429.3
1,2,4-Trichlorobenzene	75	1	1	28.29	28.29	1,3830
1,2,4-Trimethylbenzene	75	35	47	1.671	83,570	4,916
1,2-Dibromoethane (EDB)	303	2	1	2,3910	37,370	7,684
1,2-Dichlorobenzene	75	3	4	7.215	270,600	7,666
1,3,5-Trimethuylbenzene	75	17	23	0.9832	137.6	3,662
1,3-Butadiene	6	0	0	N/A	N/A	11,960
1,4-Dichlorobenzene	158	5	3	6.012	222,500	3,432
1,4-Dioxane	6	0	0	N/A	N/A	19,480
2-Hexanone	75	6	8	11.06	163.9	6,985
4-Ethyl Toluene	74	29	39	5.899	63,910	6,268
Acetone	75	36	48	3.564	546.5	7,191
Acetonitrile	328	7	2	18.45	184.5	2,433
Benzene	875	209	24	0.575	13,000,000	88,940
Carbon Tetrachloride	75	1	1	62.36	62.36	3,935
Carbon disulfide	75	3	4	1.65	17.13	9,397
Chloroethane	303	1	0	8.178	8.178	3,078
Chloroform	495	17	3	13.14	7,787	554

Table 8. Summary of Shallow Soil Gas Data Collected on the Developed Portion of the Del Amo Site

All Units µg/m^3

Chemical	Number Of Samples	Number Of Hits	Frequency Of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Mean Concentration
Chloromethane	**69**	**6**	**9**	**2.92**	**95.99**	**1,772**
Cyclohexane	**669**	**58**	**9**	**12.39**	**11,360,000**	**58,840**
Dichlorobromomethane	**75**	**2**	**3**	**19.45**	**2,549,000**	**39,960**
Ethanol	**6**	**1**	**17**	**13.75**	**13.75**	**10,190**
Ethylbenzene	**841**	**155**	**18**	**6.07**	**78,040,000**	**194,900**
Freon 11	**74**	**23**	**31**	**7.284**	**7,284**	**2,555**
Freon 113	**75**	**19**	**25**	**9.197**	**61,310**	**6,882**
Freon 114	**68**	**3**	**4**	**2.796**	**643.1**	**4,808**
Freon 12	**56**	**7**	**13**	**1.683**	**1,930**	**4,170**
Heptane	**6**	**3**	**50**	**1.803**	**4,508,000**	**949,400**
Isopropanol	**6**	**1**	**17**	**0.9586**	**9,586**	**13,290**
Methyl ethyl ketone (MEK)	**479**	**13**	**3**	**7.077**	**144.5**	**897.8**
Methyl isobutyl ketone (MIBK)	**75**	**2**	**3**	**12.27**	**110.4**	**5016**
Methyl tert-butyl ether	**6**	**0**	**0**	**N/A**	**N/A**	**19,480**
Methylene chloride	**571**	**3**	**1**	**5.562**	**6.605**	**583.7**
Styrene	**841**	**67**	**8**	**5.955**	**8,082,000**	**11,300**
Tetrachloroethylene	**613**	**211**	**34**	**9.505**	**1,426,000**	**9,013**
Tetrahydrofuran	**6**	**0**	**0**	**N/A**	**N/A**	**15,950**
Toluene	**841**	**155**	**18**	**2.494**	**1,565,000**	**9,012**
Trichloroethylene	**612**	**67**	**11**	**18.22**	**2,872,000**	**9,159**
Vinyl chloride	**73**	**0**	**0**	**N/A**	**N/A**	**1,955**

Table 8. Summary of Shallow Soil Gas Data Collected on the Developed Portion of the Del Amo Site **All Units μg/m³**						
Chemical	**Number Of Samples**	**Number Of Hits**	**Frequency Of Detection**	**Minimum Concentration Detected**	**Maximum Concentration Detected**	**Mean Concentration**
Xylenes (Total)	**297**	**51**	**17**	**6.503**	**186,400**	**2,140**
cis-1,2-Dichloroethylene	**496**	**1**	**0**	**5.945**	**5.945**	**502.7**
m,p-Xylene	**6410**	**31**	**8**	**0.8251**	**1,042,000**	**7,421**
n-Hexane	**6**	**2**	**33**	**3,2430**	**59,920**	**15,410**
o-Xylene	**6**	**2**	**33**	**0.9971**	**320,800**	**54,270**

Data obtained from Section 2, Pilot feasibility study, summary of RI/FS investigation and findings (draft) (4). Soil gas samples (approximately 900) were collected in places around the site where VOCs were stored, transported, or disposed. This table presents the shallow soil gas samples collected from 1 to 15 feet below ground surface (bgs). The soil gas samples were typically analyzed for the BTEX compounds, to a lesser extent for the common chlorinated solvent VOCs, and to a small extent (approximately 70 of the 900 samples) the samples were analyzed for the entire suite of VOCs. At times, the detection limits for the soil gas samples were very high, resulting in non-detections where there may have been chemicals present.
$\mu g/m^3$- milligrams per meter cubed

Table 9. Summary of Workplace Air Monitoring Study at the Del Amo Site							
Chemical	**In/Out**	**Number of**		**Value (ppb)**			**Typical Concentrations Mean/Max**	**Health Comparison Value (Source) All values in ppb**
		Res	**Detections**	**Maximum**	**Minimum**	**Average**		
Benzene	**Indoor**	**121**	**116**	**38**	**0.38**	**3.75**	**13/97**	**0.03 (CREG)** **4 (Intermediate MRL)**
	Outdoor	**39**	**35**	**5.2**	**0.185**	**1.76**	**7.1/25**	
Chlorobenzene	**Indoor**	**121**	**2**	**0.81**	**0.08**	**0.16**	**<0.23**	**13.5 (Ambient Air PRG)**
	Outdoor	**39**	**0**	**0.22**	**0.09**	**0.15**	**<0.23/0.11**	
Chloroform	**Indoor**	**121**	**3**	**0.8**	**0.08**	**0.16**	**1.4/12**	**20 (Chronic MRL)** **50 (Intermediate MRL)** **0.008 (CREG)**
	Outdoor	**39**	**1**	**0.25**	**0.09**	**0.16**	**0.47/75**	
Cyclohexane	**Indoor**	**121**	**55**	**60**	**0.4**	**3.03**	**N/A**	**6,112 (Ambient Air PRG)**
	Outdoor	**39**	**14**	**5.5**	**0.45**	**1.55**	**N/A**	
1, 1-Dichloroethane	**Indoor**	**121**	**1**	**0.63**	**0.08**	**0.16**	**N/A**	**128 (Ambient Air PRG)** **0.3 (Cal modified PRG)**
	Outdoor	**39**	**0**	**0.22**	**0.09**	**0.15**	**N/A**	
1,2-Dichloroethane	**Indoor**	**121**	**0**	**0.24**	**0.08**	**0.15**	**<0.20/0.23**	**0.01 (CREG)** **600 (Chronic MRL)**
	Outdoor	**39**	**0**	**0.22**	**0.09**	**0.15**	**N/A**	
1,1-Dichloroethylene	**Indoor**	**121**	**1**	**0.61**	**0.08**	**0.16**	**<0.18**	**17.6 (Chronic REL)** **0.005 (CREG)** **20 (Chronic MRL)**
	Outdoor	**39**	**0**	**0.22**	**0.09**	**0.15**	**<0.18**	
1,2-Dichloroethylene	**Indoor**	**121**	**0**	**0.24**	**0.08**	**0.15**	**N/A**	**200 (Intermediate MRL)**
	Outdoor	**39**	**0**	**0.22**	**0.09**	**0.15**	**N/A**	
1,2-Dibromoethane (EDB)	**Indoor**	**121**	**0**	**0.23**	**0.18**	**0.21**	**N/A**	**0.0065 (CREG)**
	Outdoor	**39**	**0**	**0.22**	**0.185**	**0.20**	**N/A**	
Ethylbenzene	**Indoor**	**121**	**113**	**17**	**0.1**	**2.63**	**5.8/40**	**1,000 (Intermediate MRL)**
	Outdoor	**39**	**35**	**3.2**	**0.185**	**1.16**	**3.2/16**	
Methyl ethyl ketone	**Indoor**	**121**	**86**	**230**	**0.5**	**16.25**	**N/A**	**340 (RfC)**
	Outdoor	**39**	**24**	**13**	**0.18**	**2.87**	**N/A**	

Table 9. Summary of Workplace Air Monitoring Study at the Del Amo Site

Chemical	In/Out	Number of		Value (ppb)			Typical Concentrations Mean/Max	Health Comparison Value (Source) All values in ppb
		Res	Detections	Maximum	Minimum	Average		
Methylene chloride	Indoor	121	70	12	0.14	1.47	23.8/489	300 (Chronic & Intermediate MRL) 0.86 (CREG)
	Outdoor	39	13	2.5	0.135	0.49	N/A	
Styrene	Indoor	121	94	15	0.095	1.42	2.9/23	60 (Chronic MRL)
	Outdoor	39	27	2.2	0.16	0.60	1.7/13	
Tetrachloroethylene	Indoor	121	86	11	0.16	1.28	6.8/53	40 (Chronic MRL) 0.49 (Ambient Air PRG)
	Outdoor	39	23	1.7	0.175	0.51	4.3/18	
Toluene	Indoor	121	121	85	0.59	12.41	N/A	80 (Chronic MRL)
	Outdoor	39	37	14	07	5.41	N/A	
1,1,1-Trichloroethane	Indoor	121	114	190	0.185	18.13	19/90	700 (Intermediate MRL)
	Outdoor	39	35	17	0.175	2.60	11/40	
Trichloroethylene	Indoor	121	32	10	0.08	0.48	1.2/15	100 (Intermediate MRL) 0.2 (Ambient Air PRG)
	Outdoor	39	4	1.3	0.09	0.21	0.22/1.6	
m,p-Xylene	Indoor	121	116	49	0.185	9.15	30/170	100 (Chronic MRL) 700 (Intermediate MRL) Both values for total Xylene
	Outdoor	39	38	12	0.47	4.22	18/90	
o-Xylene	Indoor	121	109	14	0.17	3.08	12/68	
	Outdoor	39	31	4	0.185	1.50	6.5/29	

In 1996, contractors for the responsible parties sampled the workplace air at twelve buildings in the developed portion of the site (4). This is a summary of the findings. These buildings were chosen because 50% or more of the building footprint is located over part of the former rubber plant VOC facility or the shallow soil gas samples collected within 25 feet of the building had indicated a potential concern. The contractors conducted air sampling on three occasions, once in the fall, winter, and spring. Three to six primary samples were collected at each building per sampling event. The number and location of sample collection points was varied based on building size, layout, worker distribution, the location of former plant site VOC facilities and a preliminary "crack and crevice" screening survey for total organic vapor using field instruments. At least one sample per building per event was collected to allow comparison of data with local ambient conditions. Eight-hour time integrated air samples were collected coinciding with the normal work day (could put the underlined part below the table). Typical concentration data are from the Team Study and the Woodland Study (41, 42). Abbreviations and acronyms used in table: N/A=not available; CREG- Cancer Risk Evaluation Guide; MRL- Minimal Risk Level; PRG- Preliminary Remediation Goal; REL- Reference Exposure Limit; ppb- parts per billion; RfC- Reference Concentration

Table 10. Summary of the Health Evaluation from Exposure to the Indoor Air on the Developed Portion of the Del Amo Site			
Potentially Exposed group		**Non-Cancer**	**Cancer**
Tract 7351-34-57	**Long-term worker**	**None of the estimated air concentrations exceed their health comparison values.**	**1.2 in 100,000** **Very low increased risk**
	Short-term worker		**6.3 in 10,000,000** **No apparent increased risk**
	Child in daycare	**The estimated concentration of benzene in indoor air exceeds its health comparison value.**	**-------**
Tract 7351-34-15,50,56	**Long-term worker**	**None of the estimated air concentrations exceed their health comparison values.**	**1.4 in 1,000,000** **No apparent increased risk**
	Short-term worker		**7.9 in 100,000,000** **No apparent increased risk**
	Child in daycare		**--------**
Tract 7351-31-18	**Long-term worker**	**None of the estimated air concentrations exceed their health comparison values.**	**1.4 in 1,000,000,000** **No apparent increased risk**
	Short-term worker		**8.0 in 100,000,000,000** **No apparent increased risk**
	Child in daycare		**--------**

The NAPL advance model, as recommended by USEPA, was used to estimate the amount and risk from soil gas that would move from the soil contamination beneath the structure into the structure (36, 37). The soil column was assumed to be composed of three stratums and soil characteristics as described in the risk assessment. The LNAPL concentration (1826 ppm in soil), the length, width and height of the LNAPL was taken from the HRS Scoring Package. Fify percent of the LNAPL plume was estimated to be beneath the building on Tract 7351-34-57 based on data in the Groundwater Remedial Investigation Report. The Johnson and Ettinger soil gas advance model, as recommended by USEPA, was used to estimate the amount and risk from soil gas that would move from the soil contamination beneath the structure into the structure (35, 39). The vadose zone soil was input as SCL. Buildings were assumed not to have basements. Building dimensions (length and width) were estimated from maps. Height of the buildings was assumed to be 300 cm. The maximum soil gas concentrations taken from building perimeter sampling (for soil gas modeling samples should be taken within the zone of influence of the building) were used, the soil gas values came from samples collected 6-7 feet bgs.. Long-term and occasional (short-term) worker weight: 70 kilograms (154 pounds). Child weight (13.5 kilograms or 30 pounds) was derived from the average of the 50th percentile of boys and girls ages 6 months to 5 years from the USEPA's Exposure Factors Handbook (44). The following were th times assumed for exposure duration: 250 days per year for 25 years for the long-term worker; 14 days per year for 25 years for the short-term worker and 250 days per year for 4.5 years for the child attending day-care. Inhalation rate was assumed to be 20 m^3/day for the worker and then child's inhalation rate (7.2 m^3/day) was derived from the average of children from 0.5 to 5 years from the USEPA's Exposure Factors Handbook (44).

Table 11. Summary of Surface Soil Data from the Waste Pits on the Del Amo Site					
TYPE OF CHEMICAL	CONSTITUENT	FILL SOIL OVERLYING		EPA REGION IX RESIDENTIAL SOIL PRG (ppm)	HEALTH COMPARISON VALUE (SOURCE); BACKGROUND RANGE FOR METAL (AVERAGE BACKGROUND CONCENTRATION)
		DISPOSAL PITS (ppm)	EVAPORATION PONDS (ppm)		
SVOC	Acenaphthylene	0.81	0.78	NA	--
SVOC	2-Methylnaphthalene	0.63	0.7	NA	--
SVOC	Phenanthrene	0.58	0.43	NA	--
SVOC	Pyrene	0.4	0.48	100	2,000 (Child RMEG)
Pesticide	4,4'-DDD	0.12	0.12	1.9	30 (Child RMEG)
Pesticide	4,4'-DDE	0.14	0.067	1.3	30 (Child RMEG)
Pesticide	4,4'-DDT	1.5	0.2	1.3	1.0 (CREG)
Metal	Arsenic	9.2	7	0.38	20 (Child Chronic EMEG) 0.5 (CREG) Bkgd=0.6-11 (3.5)
Metal	Barium	170	170	5,300	4,000 (Child RMEG) Bkgd=133-1,400 (509)
Metal	Cadmium	6.2	6.7	9	10 (Child EMEG) Bkgd=0.05-1.7 (0.36)
Metal	Chromium	56	35	210	80,000 (Child RMEG) Bkgd=23-1,579 (122)
Metal	Cobalt	12	12	4,600	500 (Child Intermediate EMEG) Bkgd=2.7-46.9 (14.9)
Metal	Copper	32 J	25 J	2,800	2,900 (Residential PRG) Bkgd=9.1-96.4 (28.7)
Metal	Lead	41	15	130	400 (Residential PRG) Bkgd=12.4-97.1 (23.9)
Metal	Manganese	640	640	3,200	3,000 (Child RMEG) Bkgd=253-1,687 (646)

Table 11. Summary of Surface Soil Data from the Waste Pits on the Del Amo Site					
TYPE OF CHEMICAL	CONSTITUENT	FILL SOIL OVERLYING		EPA REGION IX RESIDENTIAL SOIL PRG (ppm)	HEALTH COMPARISON VALUE (SOURCE); BACKGROUND RANGE FOR METAL (AVERAGE BACKGROUND CONCENTRATION)
		DISPOSAL PITS (ppm)	EVAPORATION PONDS (ppm)		
Metal	Nickel	21	17	150	1,000 (Child RMEG) Bkgd=9-509 (57)
Metal	Vanadium	48	47	540	200 (Child Intermediate EMEG) Bkgd=39-288 (112)
Metal	Zinc	120	88	23,000	20,000 (Child Chronic EMEG) Bkgd=88-236 (149)

As a part of the phase I remedial investigation, one composite sample was collected from the disposal pits and one composite sample was collected from evaporation ponds (22). Specifically, three locations (SSL0017, SSL0018, and SSL0019) overlying the 2 series pits were sampled and combined into one composite sample and four locations (SSL0020, SSL0021, SSL0022, and SSL0023.) overlying the 1 series pits and the eastern evaporation pond were sampled and composited. The two samples were analyzed for SVOCs, pesticides/PCBs, metals, and cyanide. Background soil data obtained from "Background concentrations of trace and major elements in California soils" (31).
Abbreviations and acronyms used in table: SVOC- semi-volatile organic compound; ppm- parts per million; RMEG- Reference Dose Media Evaluation Guide; CREG- Cancer Risk Evaluation Guide; EMEG- Environmental Media Evaluation Guide; Bkgd- background; DDT- dichlorodiphenyltrichloroethane; DDE- dichlorodiphenyldichloroethane; DDT- dichlorodiphenylchloroethane; NA- not available.

Table 12. Summary of Ambient Air Contaminants Detected at the Waste Pits on the Del Amo Site and in 204th Street Backyards					
Chemical	**Level Measured in Air near Waste Pits (ppb)**	**Level Measured in Air in Backyards (ppb)**	**SCAQMD's Maximum Background Levels (ppb)**	**Health Comparison Levels (ppb)**	**References for the Health Comparison Levels**
1,1,1-Trichloroethane	6.52J	2.23	5.40	700	I MRL
1,2,4-Trimethylbenzene	2.8	2.4	NA	NA	-----
1,2-Dichlorobenzene	2.6	ND	0.40	34.64	PRG
1,3,5-Trimethylbenzene	0.82	0.7	NA	NA	-----
1,4-Dichlorobenzene	0.93	ND	0.40	200	i-EMEG/MRL
Benzene	3.2	2.8	5.50	0.03	CREG
Ethylbenzene	1.4	1.4	1.43	300	i-EMEG/MRL
Isopropylbenzene	4.9	0.8	NA	1.91	PRG
m,p-Xylene	8.3	5.4	2.4	300/40	a-EMEG/MRL
Methylene chloride	12	104.1	2.6	0.86	CREG
n-Propylbenzene	0.55	ND	NA	NA	-----
o-Xylene	2.9	1.29	16.50	400	a-EMEG/MRL
p-Isopropyl toluene	0.93	0.8	NA	NA	-----
Styrene	1.9	0.7	1.10	235	RfC
Tetrachloroethylene	2.3	8.3	2.00	0.29	CREG
Toluene	10	0.05	9.4	106.15	RfC
Naphthalene	0.12	0.05	NA	2	c-EMEG
Acenapthalene	0.002	0.000097	NA	34.9	-----
Acenapthylene	0.006	0.00019	NA	NA	-----
Fluorene	0.002	0.00018	NA	22.1	PRG
Phenanthrene	0.002	0.00035	NA	NA	PRG

Table 12. Summary of Ambient Air Contaminants Detected at the Waste Pits on the Del Amo Site and in 204th Street Backyards					
Chemical	**Level Measured in Air near Waste Pits (ppb)**	**Level Measured in Air in Backyards (ppb)**	**SCAQMD's Maximum Background Levels (ppb)**	**Health Comparison Levels (ppb)**	**References for the Health Comparison Levels**
Anthracene	**0.002**	**0.00014**	**NA**	**151**	**PRG**
Fluoranthene	**0.001**	**0.000033**	**NA**	**18.1**	**PRG**
Pyrene	**0.001**	**0.000031**	**NA**	**13.3**	**PRG**

Data obtained from Del Amo facility health consultation, potential health impacts due to the emissions from the waste pits (43)

ppm = pats per million
ND = not detected
NA = not available
PRG = USEPA Preliminary Remediation Goals
RfC = USEPA Reference Concentration
CREG = ATSDR Cancer Risk Evaluation Guide for 1 x 10^{-6} excess cancer risk
a-EMEG = ATSDR acute Environmental Media Evaluation Guide
c-EMEG = ATSDR chronic Environmental Media Evaluation Guide
I-EMEG = ATSDR intermediate Environmental Media Evaluation Guide
MRL = ATSDR Minimal Risk Levels

Table 13. Summary of the Health Evaluation from Exposure to the Indoor Air in the Neighborhood to the South of the Del Amo Site		
Potentially exposed group	**Non-cancer**	**Cancer**
Residents on the western side (near Normandie Avenue)	**None expected. None of the estimated indoor air levels exceed health comparison values**	**4 in 10,000,000 No apparent increased cancer risk**
Residents on the eastern side (near Vermont Avenue)	**None expected. None of the estimated indoor air levels exceed health comparison values**	**8 in 100,000,000 No apparent increased cancer risk**

The revised Johnson and Ettinger soil screening model as adopted by the USEPA was used to estimate indoor air exposures in residences located south of the Del Amo site situated over contaminated groundwater plumes (45). For the residents living on the western side (near Normandie Avenue), monitoring well data for SWL0049 was used. For the residents on the eastern side (near Vermont Avenue), monitoring well data for SWL0057 was used. These wells were chosen for modeling because they are wells that have measurable levels of contamination in them and the wells are located in the neighborhood. Data were obtained from the Groundwater Remedial Investigation Report (2). Default values were used for the soil characteristics. Depth to groundwater= 1435 cm or 47 feet.

Table 14. Summary of Surface and Near Surface Soil Data from the Neighborhood South of the Del Amo Site[$]

Date of Sampling	1983		1993	1995		Health Comparison Value(Source); Background Metal Concentration
Depth of Sample (bgs)	0-0.5 ft.	2-3 ft.	0-0.5ft.	0.5 ft.	2 ft.	
Number of Samples	9	9	21	66[*]	64[#]	
All VOCs	NA	NA	NA	<0.654-2.17	<0.144-1.85	-
Arsenic	4.5-19.4 (10.1)	8.16-12 (10.4)	2.5-14 (4.6)	3.23-9.37 (5.86)	3.39-3.8 (3.60)	20 (Child Chronic EMEG) 0.5 (CREG) Bkgd=0.6-11 (3.5)
Barium	71.2-169 (117)	137-219 (160)	110-450 (195)	56.2-253 (133)	17-460 (129)	4,000 (Child RMEG) Bkgd=133-1,400 (509)
Cadmium	0.91-6.67 (2.1)	1.22-2.12 (1.6)	1.5-29 (8.5)	0.85-30.2 (4.89)	0.15-881 (164)	10 (Child EMEG) Bkgd=0.05-1.7 (0.36)
Chromium	8.83-51.4 (20.9)	16.8-47.7 (24.7)	22-210 (52)	15.7-24.6 (9.15)		80,000 (Child RMEG) Bkgd=23-1,579 (122)
Cobalt	6.19-19.7 (9.6)	8.42-10.7 (9.6)	8.9-16 (12)	0.74-24.6 (9.15)	2.93-156 (18.1)	500 (Child Intermediate EMEG) Bkgd=2.7-46.9 (14.9)
Copper	11.0-24.6 (19)	14.9-23.3 (17.7)	26-1,600 (141)	2.48-459 (95.5)	20.7-156 (68.6)	2,900 (Residential PRG) Bkgd=9.1-96.4 (28.7)
Lead	20.7-88.1 (37.4)	13-28.2 (19.4)	54-450 (150)	9.5-2,280 (183)	6.0-392 (104)	400 (Residential PRG) Bkgd=12.4-97.1 (23.9)
Nickel	5.08-24.0 (12.8)	10.4-23.0 (13.7)	15-570 (92)	12.4-585 (160)	15.2-345 (102)	1,000 (Child RMEG) Bkgd=9-509 (57)
Vanadium	NA	NA	33-71 (50)	23.8-137 (38.7)	6.3-84 (38)	200 (Child Intermediate EMEG) Bkgd=39-288 (112)
Zinc	38.4-135 (75.6)	41.4-58.1 (48.0)	140-1,600 (335)	69.3-1100 (266)	15.8-497 (138)	20,000 (Child Chronic EMEG) Bkgd=88-236 (149)

Table 14. Summary of Surface and Near Surface Soil Data from the Neighborhood South of the Del Amo Site$						
Date of Sampling	1983		1993	1995		Health Comparison Value(Source); Background Metal Concentration
Depth of Sample (bgs)	0-0.5 ft.	2-3 ft.	0-0.5ft.	0.5 ft.	2 ft.	
Number of Samples	9	9	21	66*	64#	
All SVOCs	<5	<5	<0.2 (except for the ones indicated below	<1.46	<0.763	---
Butylbenzylphthalate	<5	<5	0.30; 0.20; 0.21	NA	NA	10,000 (Child RMEG)
Bis(2-ethylhexyl)phthalate	<5	<5	0.35; 0.71; 0.61; 1.4	NA	NA	35 (Residential PRG)
Benzo(a)anthracene	<5	<5	0.24	NA	NA	0.01 (BAP-eq CREG)
Benzo(a)pyrene	<5	<5	0.2	NA	NA	0.1 (CREG)
Benzo(b)fluoranthene	<5	<5	0.28	NA	NA	0.01 (BAP-eq CREG)
Chrysene	<5	<5	0.37	NA	NA	10 (BAP-eq CREG)
Dimethylphthalate	<5	<5	0.25	NA	NA	100,000 (Residential PRG)
Phenanthrene	<5	<5	0.47; 0.22	NA	NA	---
Phenol	<5	<5	0.78; 0.31	NA	NA	30,000 (Child RMEG)
Di-n-butylphthalate	<5	<5	0.20	NA	NA	6,100 (Residential PRG)
Fluoranthene	<5	<5	0.27	NA	NA	2,000 (Child RMEG)
Di-n-octylphthalate	<5	<5	<5	NA	NA	1,200 (Residential PRG)
DDT (total)	0.035-1.7 (0.420)	0.003-0.218 (0.039)	1.04-111 (11.83)	<2.02-147 (3.49)	<0.219-70.5 (1.52)	30 (Child RMEG) 2 (CREG)

$ Sampling data and background concentrations presented as ranges followed by the average in parentheses. Data obtained from a number of sources (5-9). *There were 66 samples analyzed for DDT and not for the full suite of contaminants. For instance, only 30 surface (0.5 ft) samples were analyzed for most metals, five for VOCs, four for SVOCs, Pesticides/PCBs, and Herbicides. Only three samples were analyzed for arsenic and selenium. #There were 64 samples analyzed for DDT and not for the full suite of contaminants. For instance, only 15 samples were analyzed for most metals, three for VOCs, two for SVOCs, Pesticides/PCBs, and Herbicides. Only two samples were analyzed for arsenic and selenium. Background soil data obtained from "Background concentrations of trace and major elements in California soils" (31).
Abbreviations and acronyms used in table: ft.- feet; bgs- below ground surface; EMEG- Environmental Media Evaluation Guide; CREG- Cancer Risk Evaluation Guide; RMEG- Reference Dose Evaluation Guide; PRG- Preliminary Remediation Guide; NA- not analyzed; VOCs- volatile organic compounds; Bkgd- background; BaP-eq- benzo(a)pyrene equivalent; SVOCs- semi-volatile organic compounds; DDT- dichlorodiphenyltrichloroethane

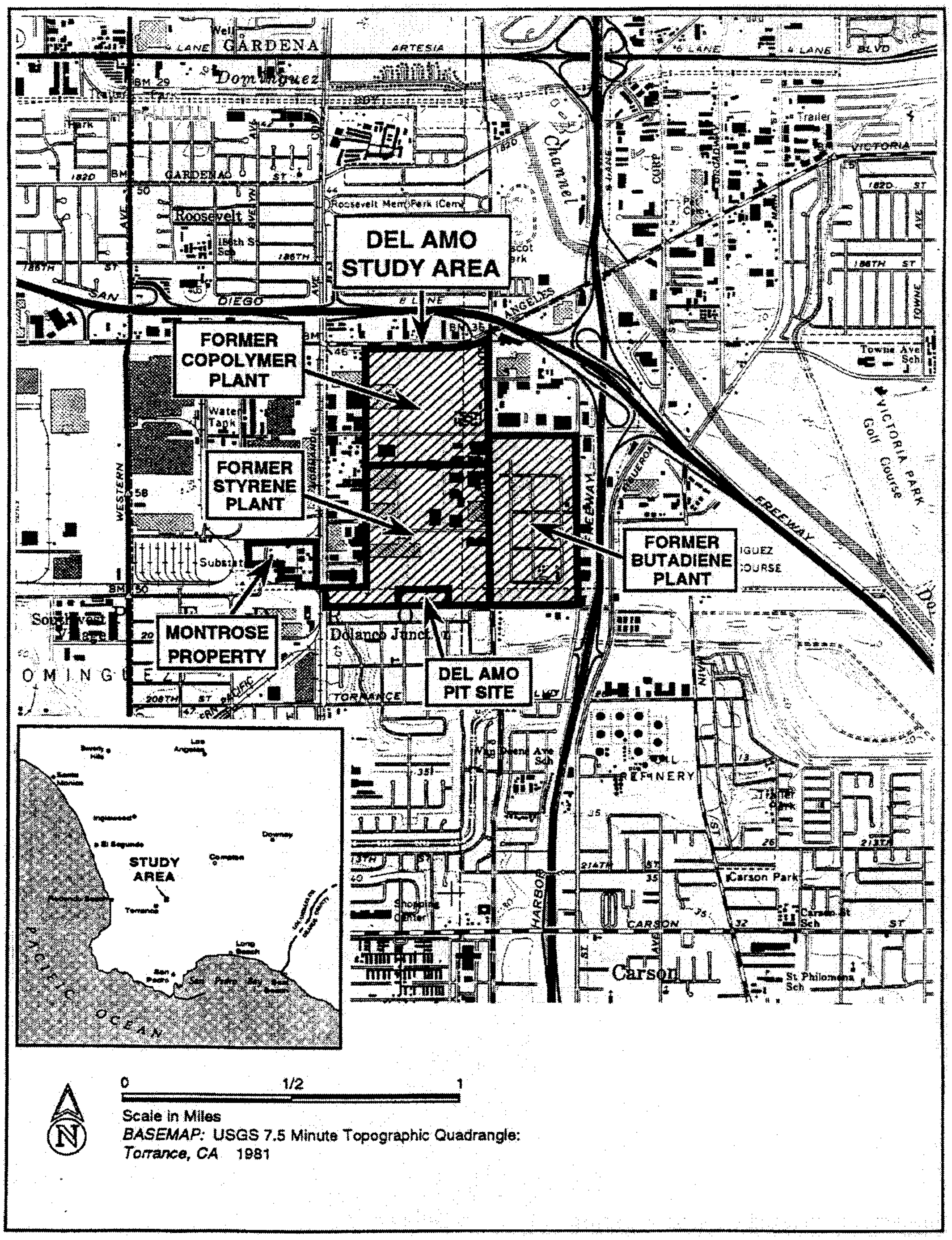
Table 15. Post-Grading Soil Tests in Proposed Neighborhood Park South of the Del Amo Site											
Chemical	**Concentration of Chemical (ppm) in Each Sample**										**Health Comparison Value (Source) Background Range (Average)**
	SS-31D	**SS-35D**	**SS-30D**	**SS-16D**	**SS-21D**	**SS-29D**	**SS-18D**	**SS-17D**	**SS-5**	**SS-6**	
Arsenic	**3.5**	**4.8**	**4.1**	**5.8**	**4.7**	**4.2**	**6.4**	**5.4**	**5.1**	**5.1**	**20 (Child Chronic EMEG) 0.5 (CREG) Bkgd=0.6-11 (3.5)**
Barium	**130**	**170**	**230**	**190**	**170**	**130**	**130**	**200**	**160**	**170**	**4,000 (Child RMEG) Bkgd=133-1,400 (509)**
Cadmium	**ND**	**ND**	**ND**	**ND**	**ND**	**0.56**	**1.2**	**ND**	**ND**	**0.62**	**10 (Child EMEG) Bkgd=0.05-1.7 (0.36)**
Chromium	**20**	**22**	**25**	**33**	**27**	**19**	**57**	**26**	**25**	**31**	**80,000 (Child RMEG) Bkgd=23-1,579 (122)**
Cobalt	**8.4**	**11**	**11**	**12**	**13**	**9.1**	**11**	**11**	**12**	**12**	**500 (Child Intermediate EMEG) Bkgd=2.7-46.9 (14.9)**
Copper	**23**	**36**	**28**	**39**	**27**	**26**	**130**	**29**	**30**	**40**	**2,900 (Residential PRG) Bkgd=9.1-96.4 (28.7)**
Lead	**22**	**39**	**15**	**26**	**15**	**120**	**44**	**28**	**14**	**29**	**400 (Residential PRG) Bkgd=12.4-97.1 (23.9)**
Nickel	**17**	**20**	**20**	**39**	**21**	**18**	**76**	**21**	**24**	**39**	**1,000 (Child RMEG) Bkgd=9-509 (57)**

Table 15. Post-Grading Soil Tests in Proposed Neighborhood Park South of the Del Amo Site											
Chemical	Concentration of Chemical (ppm) in Each Sample										Health Comparison Value (Source) Background Range (Average)
	SS-31D	SS-35D	SS-30D	SS-16D	SS-21D	SS-29D	SS-18D	SS-17D	SS-5	SS-6	
Vanadium	39	44	52	55	51	35	53	50	50	50	200 (Child Intermediate EMEG) Bkgd=39-288 (112)
Zinc	99	190	76	88	74	160	110	120	78	110	20,000 (Child Chronic EMEG) Bkgd=88-236 (149)

Data obtained from the Environmental mitigation closure report, neighborhood park project (24).
Background soil data obtained from "Background concentrations of trace and major elements in California soils" (31).
Abbreviations and acronyms used in the table: ppm- parts per million; EMEG- Environmental Media Evaluation Guide; CREG- Cancer Risk Evaluation Guide; RMEG- Reference Dose Media Evaluation Guide; Bkgd- background; PRG- Preliminary Remediation Goal

Appendix C - Figures

Figure 1. Location of the Del Amo Site
(Data Source: Dames & Moore Location Map)



1 inch = 3,750 ft = .71 miles

Figure 2. Del Amo Site and Surrounding Zip Codes

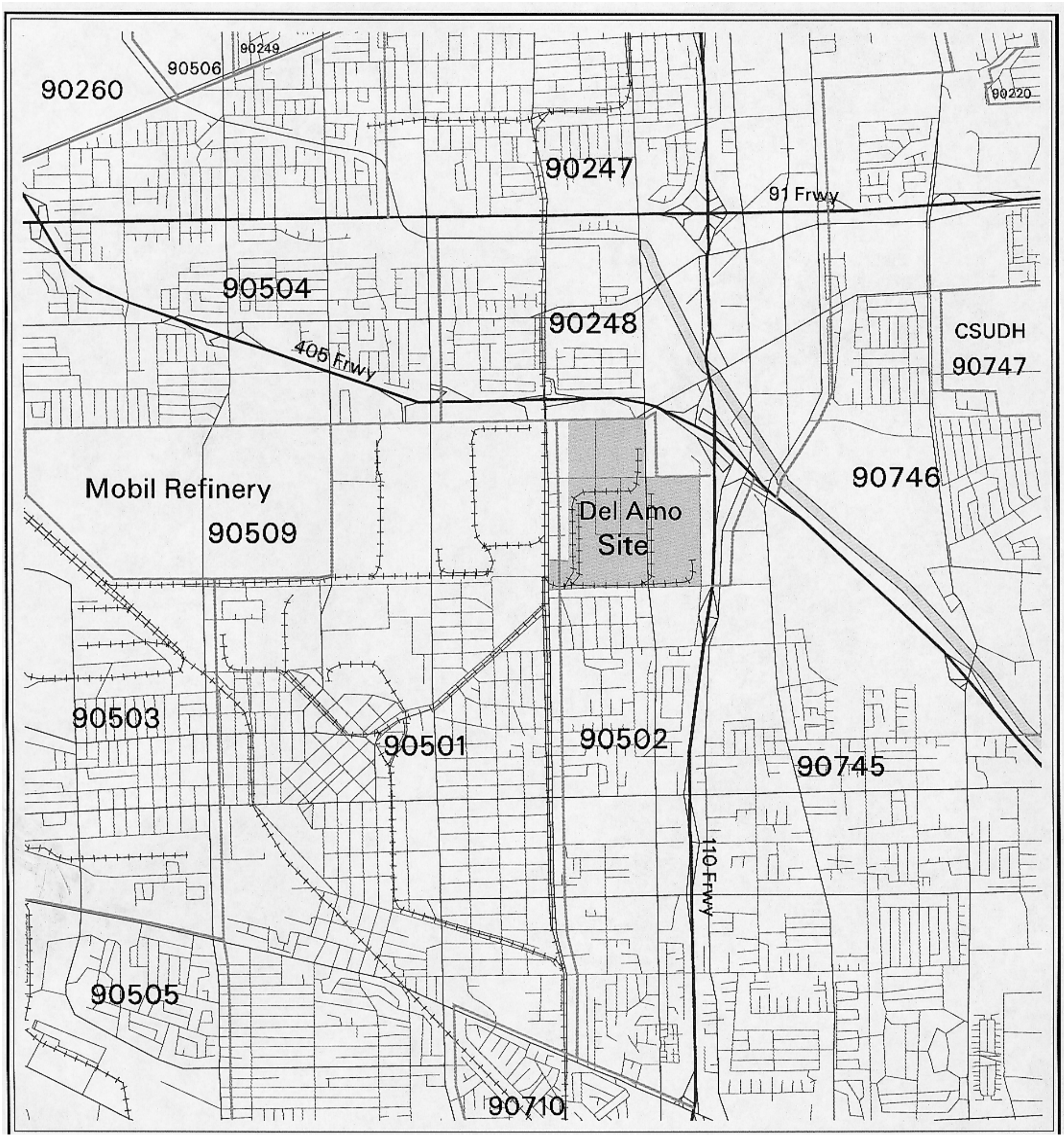


Figure 3. Exposure Areas of Potential Concern

(Data Source: URS Baseline Risk Assessment)

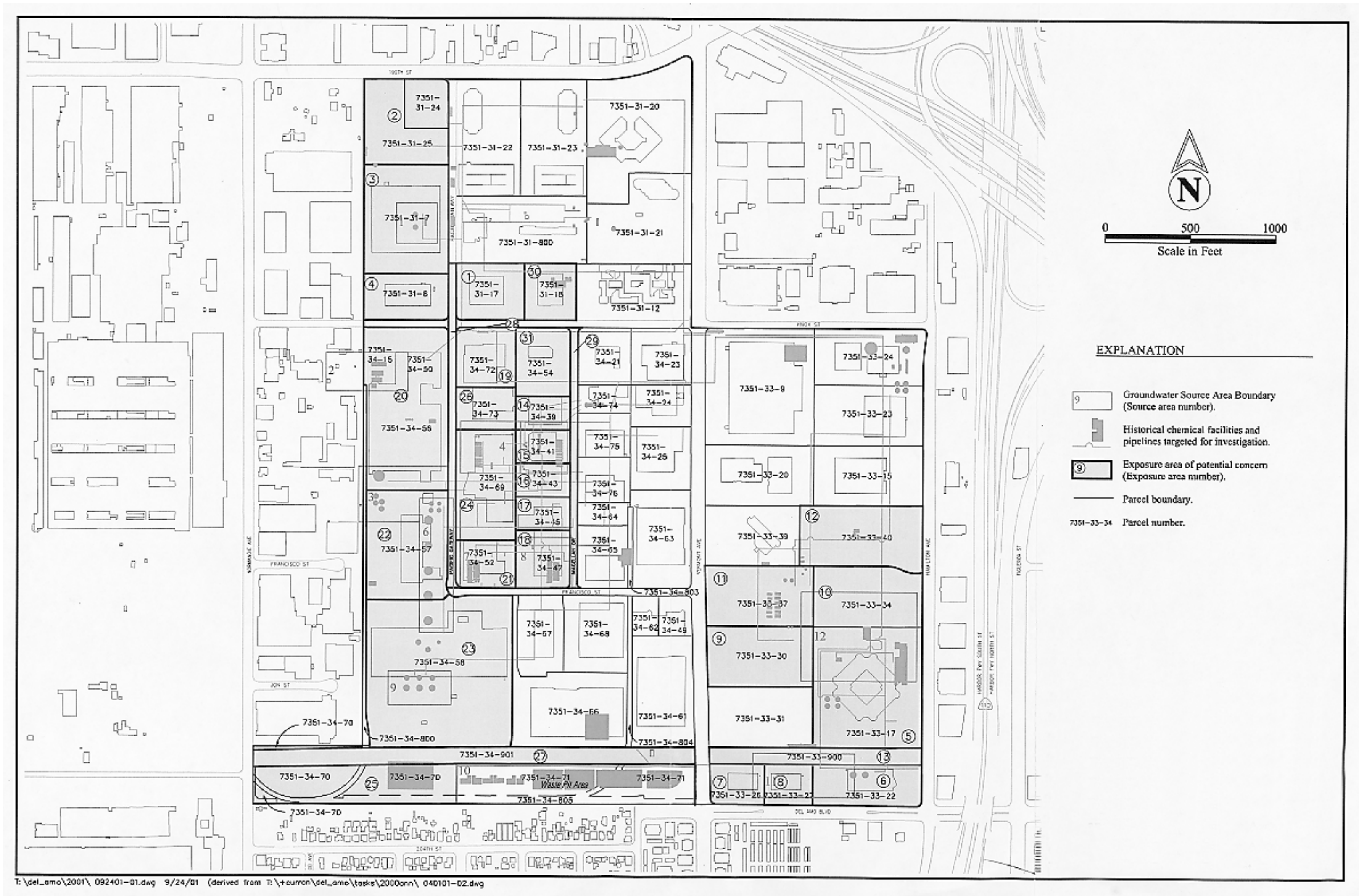
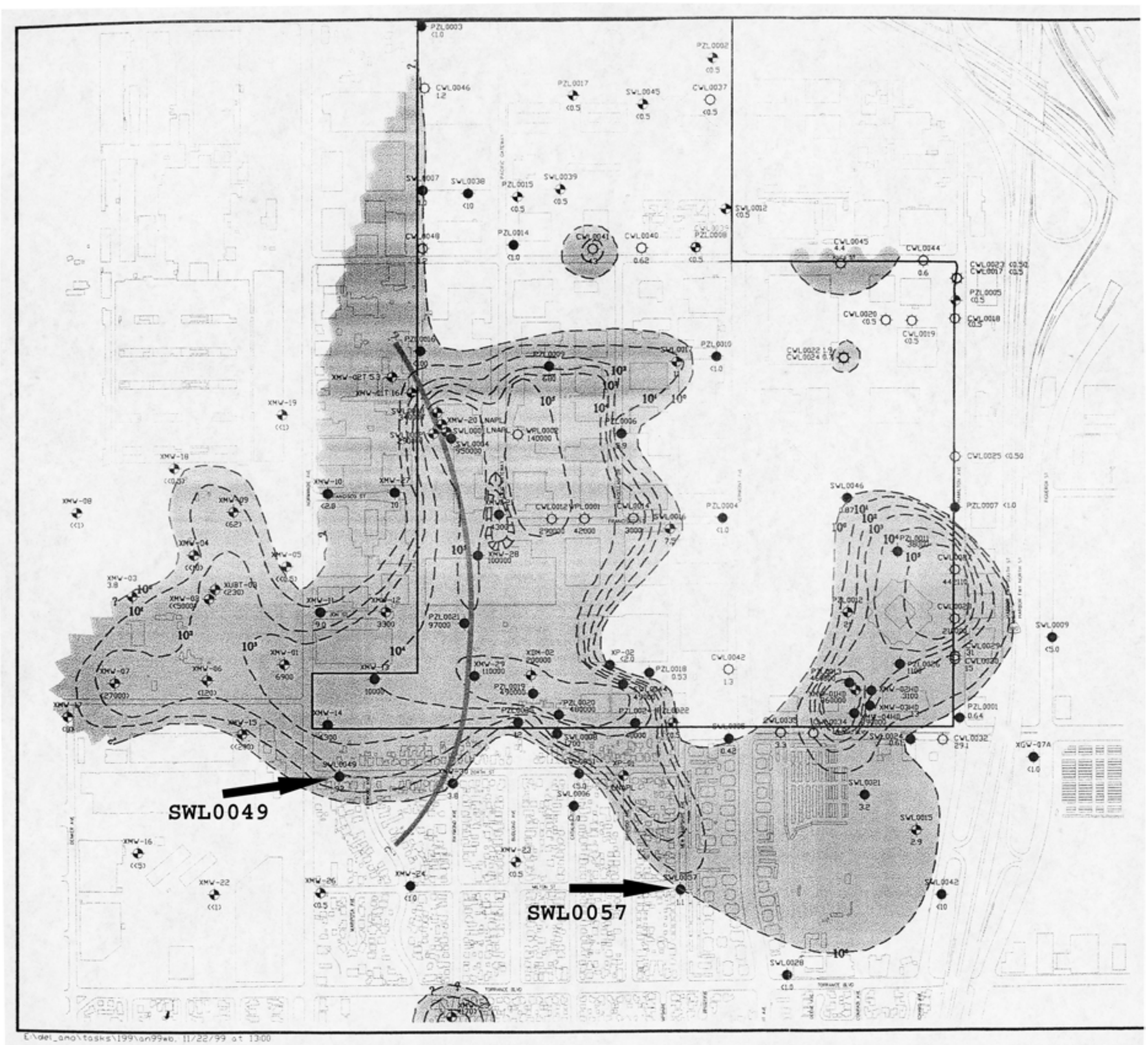


Figure 4. Benzene Groundwater Contamination in the Watertable Closest to the Surface



N

0 600 1200

Scale in Feet

EXPLANATION

SWL0004 920000	Groundwater monitoring location with 1999 benzene concentration
SWL0001 LNAPL	Groundwater monitoring location where LNAPL is present
XMW-04HD 980000	Groundwater monitoring location with historical benzene concentration
CWL0027 442110	Temporary well point with historical benzene concentration
	Approximate extent of dissolved benzene plume (≥ 1 µg/L)
10^5	Benzene concentration isopleth in µg/L
? ?	Inferred intersection of water table surface with top of middle Bellflower B sand. The overlying upper Bellflower aquitard is unsaturated west of the inferred intersection.

Figure 5. Locations of Groundwater Contamination Sources in Addition to the Del Amo Site
(Data Source: Dames and Moore Groundwater Remedial Investigation Report)

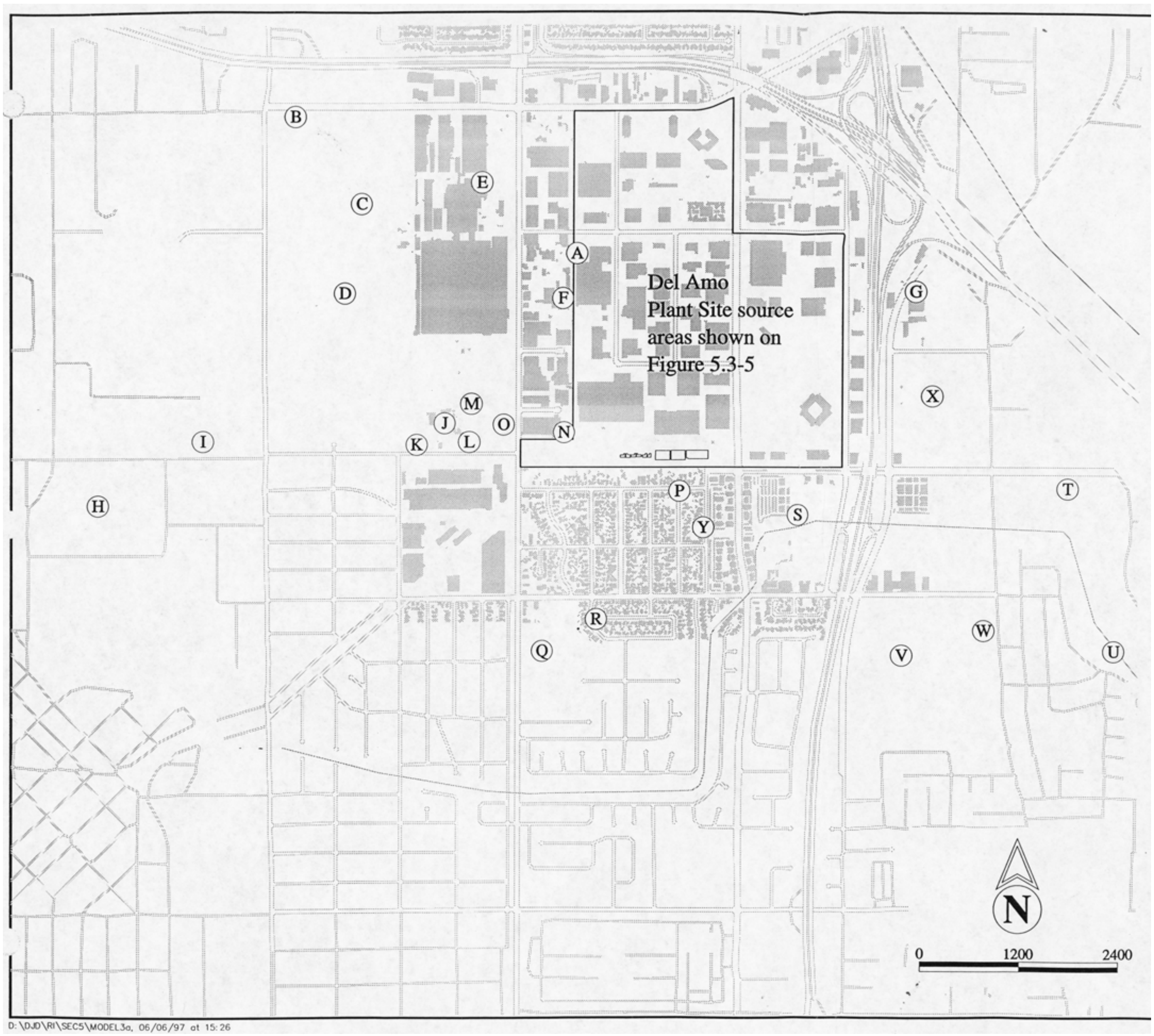


Figure 5. Locations of Groundwater Contamination Sources in Addition to the Del Amo Site - *Continued*

Source	Local Facility*	Chemicals with Elevated Concentrations in Groundwater
A	Amoco/Del Amo (?)	TCE, PCE, chloroform
B	International Light Metals	TCE
C	International Light Metals/McDonnell Douglas	TCE
D	International Light Metals	TCE, PCE, 1,1-DCE, 1,1-DCA
E	McDonnell Douglas	1,1-DCE, toluene, benzene, TCE, 1,1,1-TCA
F	Trico	1,1-DCA, TCE, PCE, vinyl chloride
G	Penske Truck Leasing	Benzene
H	Mobil Oil Refinery	BTEX
I	Allied Signal	1,1-DCE, 1,1-DCA, 1,1,1-TCA, benzene
J	Jones Chemical	TCE, PCE, 1,1-DCE
K	XMW-07 LNAPL	BTEX, 1,1-DCA
K	Jones Chemical	TCE, PCE, benzene, 1,1-DCE, 1,1-DCA
M	Montrose	Chlorobenzene, p-CBSA, chloroform
N	unknown	BTEX, TCE, 1,2-DCA, 1,2,4-trimethylbenzene
O	unknown	Benzene
P	P-1 LNAPL Pipeline leakage?	Benzene, naphthalene
Q	Azko	Toluene
R	Amco	BTEX, chlorobenzene, p-CBSA
S	Gardena Valley Landfill	Benzene, PCE, TCE, vinyl chloride
T	Cal Compact Landfill	Vinyl chloride, TCE, PCE, cis-1,2-DCE, benzene
U	Cal Compact Landfill	BTEX
V	Golden Eagle Refinery	BTEX
W	Golden Eagle Refinery	Vinyl chloride, cis-1,2-DCE, TCE, PCE
X	Southwest Conservation Landfill	PCE, TCE, 1,1-DCA, vinyl chloride
Y	Boring SBL0102 LNAPL Pipeline leakage?	Groundwater not tested

*** Indicates only the name of the local facility at the time the analytical data was collected and does not necessarily reflect responsibility for the contamination present.**

Figure 6. Chlorobenzene Groundwater Contamination in the Water Table Closest to the Surface
(Data Source: Dames and Moore Groundwater Remedial Investigation Report)

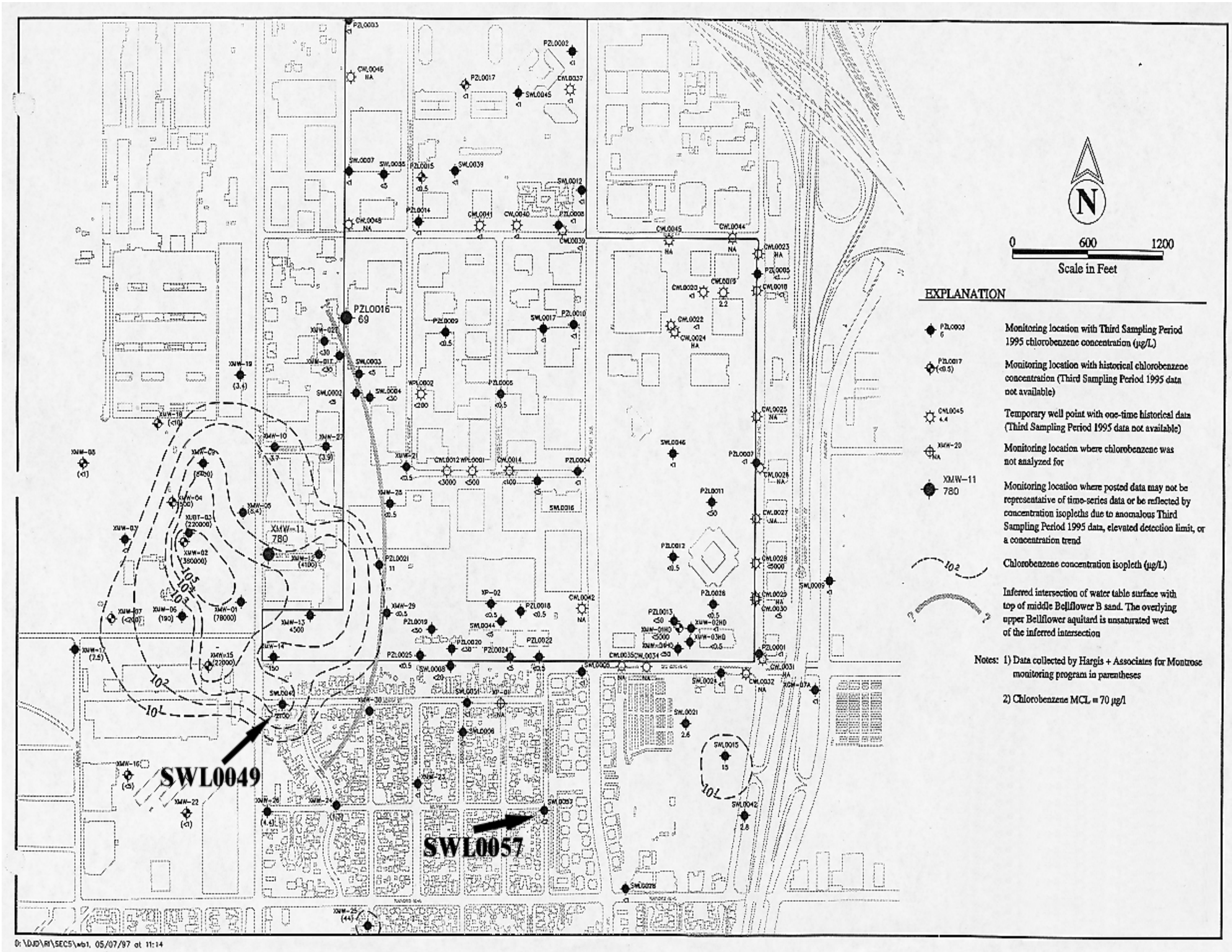
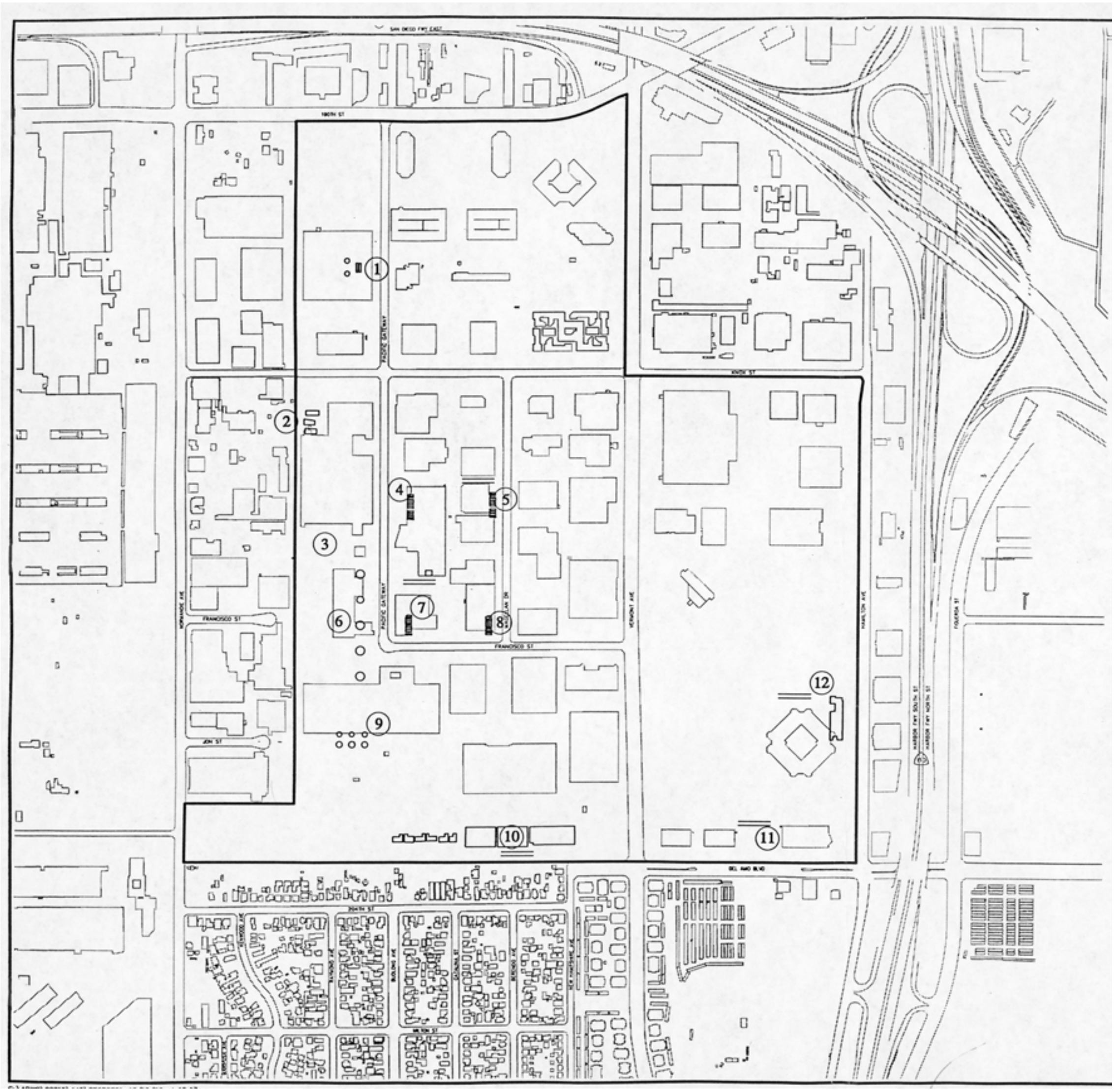
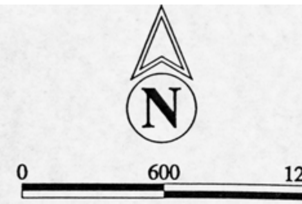
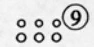


Figure 7. Locations of Source Areas for Groundwater Contamination on the Del Amo Site
(Data Source: Dames and Moore Groundwater Remedial Investigation Report)





EXPLANATION

 Approximate location of groundwater contamination source areas

Source Area Number	Suspected Former Source Facility	Local Water Table Monitoring Locations	VOCs with Elevated Concentrations in Groundwater	VOCs with Elevated Concentrations in Soil Gas
1	cyclohexane tanks	SWL0038	cyclohexane	soil gas sampling not conducted (inaccessible)
2	offsite Amoco facility and/or onsite "pits and trenches"	PZL0016	TCE PCE chloroform	TCE PCE
3	XMW-20 LNAPL (benzene tank and/or pipeline)	XMW-20 SWL0001 SWL0002 SWL0003 SWL0004 SWL0032	benzene (LNAPL) toluene ethylbenzene	benzene toluene ethylbenzene styrene
4	VOC tanks in styrene finishing/benzene purification unit	WPL0002 PZL0009	benzene ethylbenzene cyclohexane	benzene cyclohexane
5	VOC tanks and/or underground pipelines in styrene finishing unit	PZL0006	BTEX styrene naphthalene	BTEX styrene cyclohexane
6	tank farm (VOC storage)	XMW-21 XMW-28	benzene ethylbenzene	benzene toluene ethylbenzene styrene
7	VOC storage tanks at ethylbenzene production unit #1	XMW-21 CWL0012	benzene ethylbenzene	BTEX cyclohexane
8	VOC storage tanks at ethylbenzene production unit #2	WPL0001	benzene ethylbenzene phenol	ethylbenzene
9	"utility tanks"	PZL0021	benzene toluene	none
10	Waste Pit Area and underground petroleum product pipelines	PZL0019 PZL0020 PZL0024 SWL0044	BTEX naphthalene phenol	soil gas sampling not conducted within waste pits
11	underground benzene pipeline	XMW-01HD XMW-04HD	benzene phenol(?)	benzene
12	laboratory, underground pipelines (?)	CWL0027 CWL0028 PZL0011	BTEX styrene cyclohexane naphthalene	benzene toluene ethylbenzene cyclohexane

Figure 8. Locations of Surface Soil Samples Analyzed for Semi-volatile Organic Compounds (SVOCs)
(Data Source: Dames and Moore Pilot Feasibility Study)

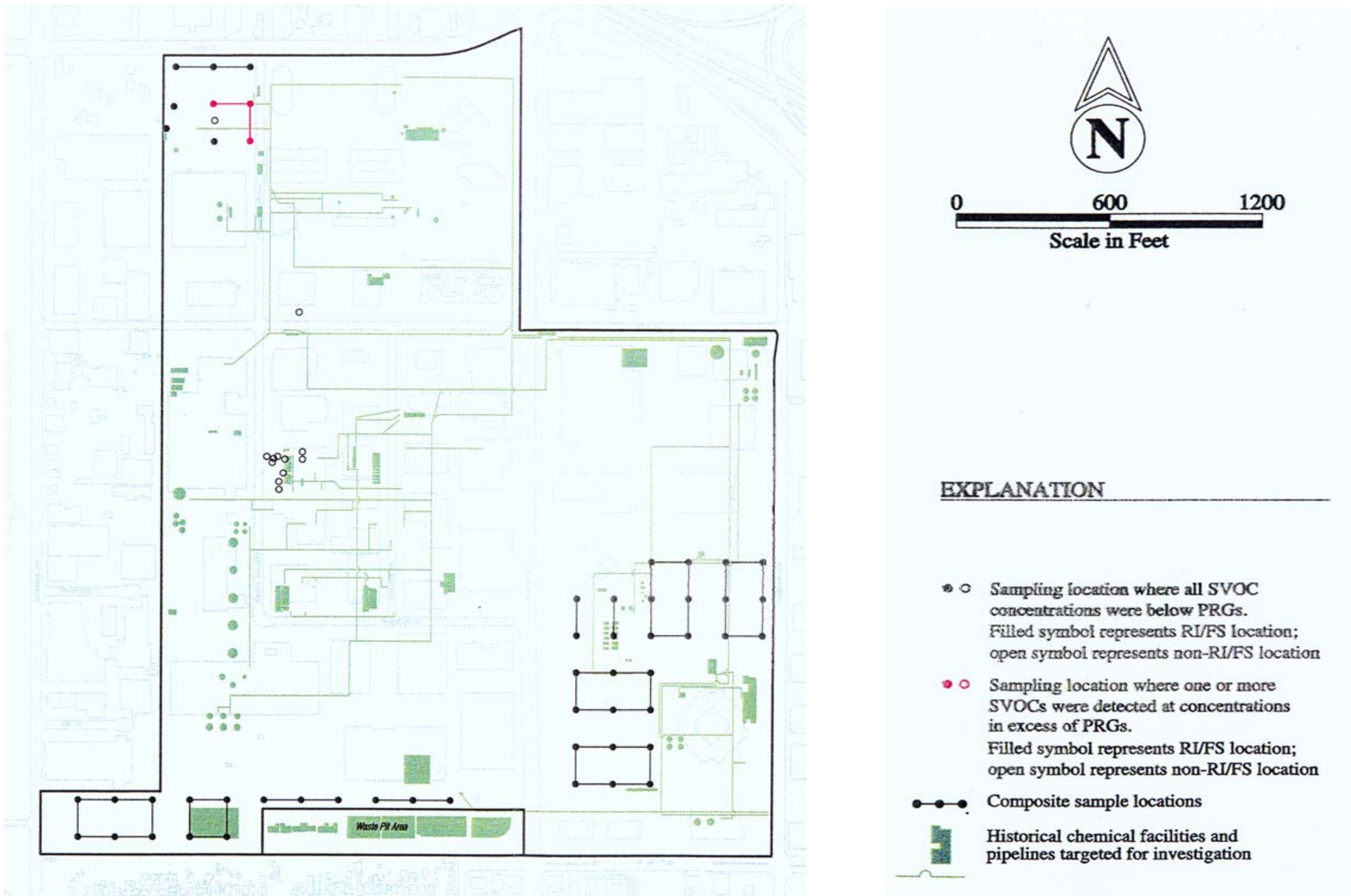


Figure 9. Locations of On-site Shallow Soil Samples Analyzed for Semi-volatile Organic Compounds (SVOCs) **(Data Source: Dames and Moore Pilot Feasibility Study)**

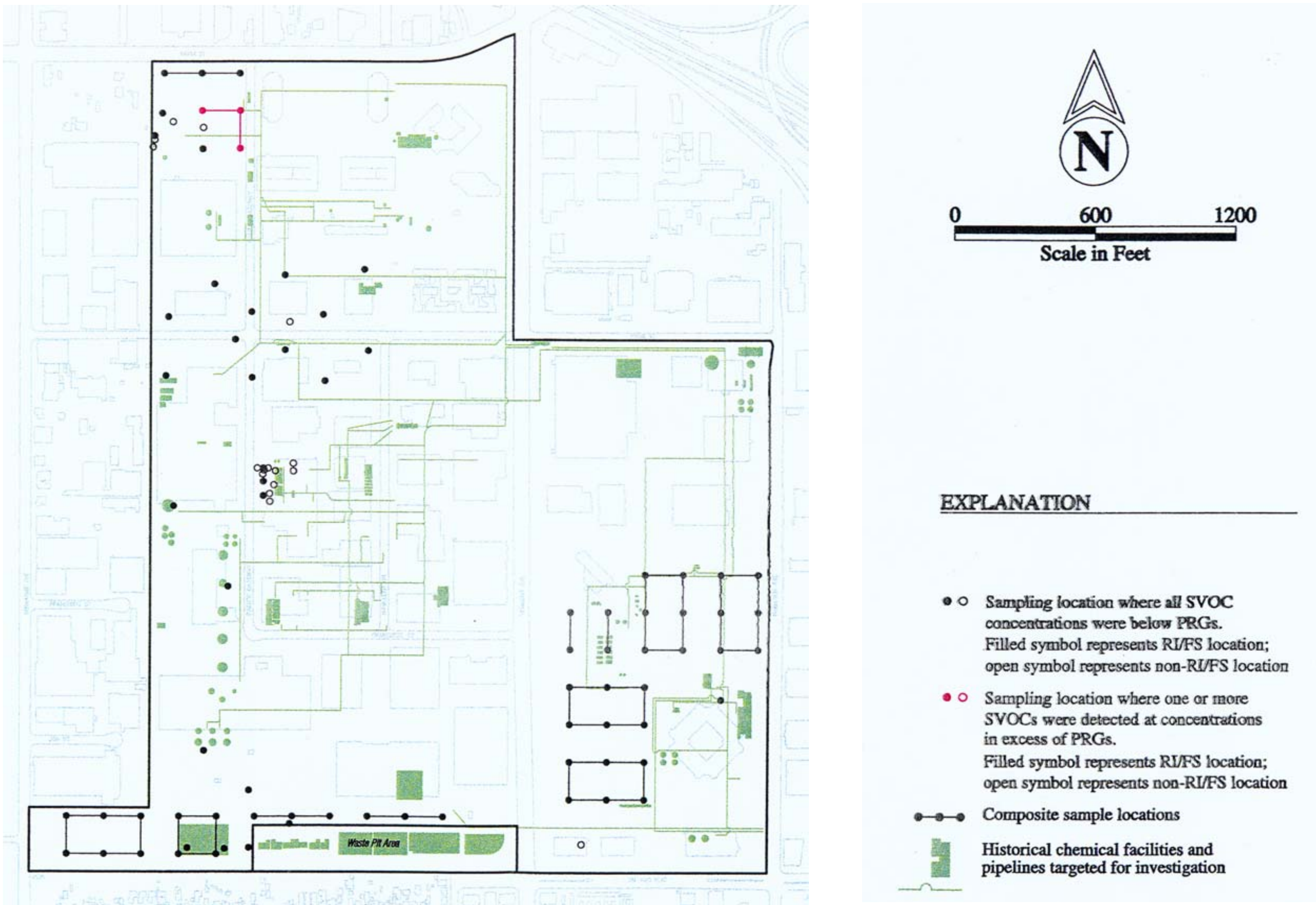


Figure 10. Locations and Results of Soil Gas Sampling on the Del Amo Site
(Data Source: URS Baseline Risk Assessment)

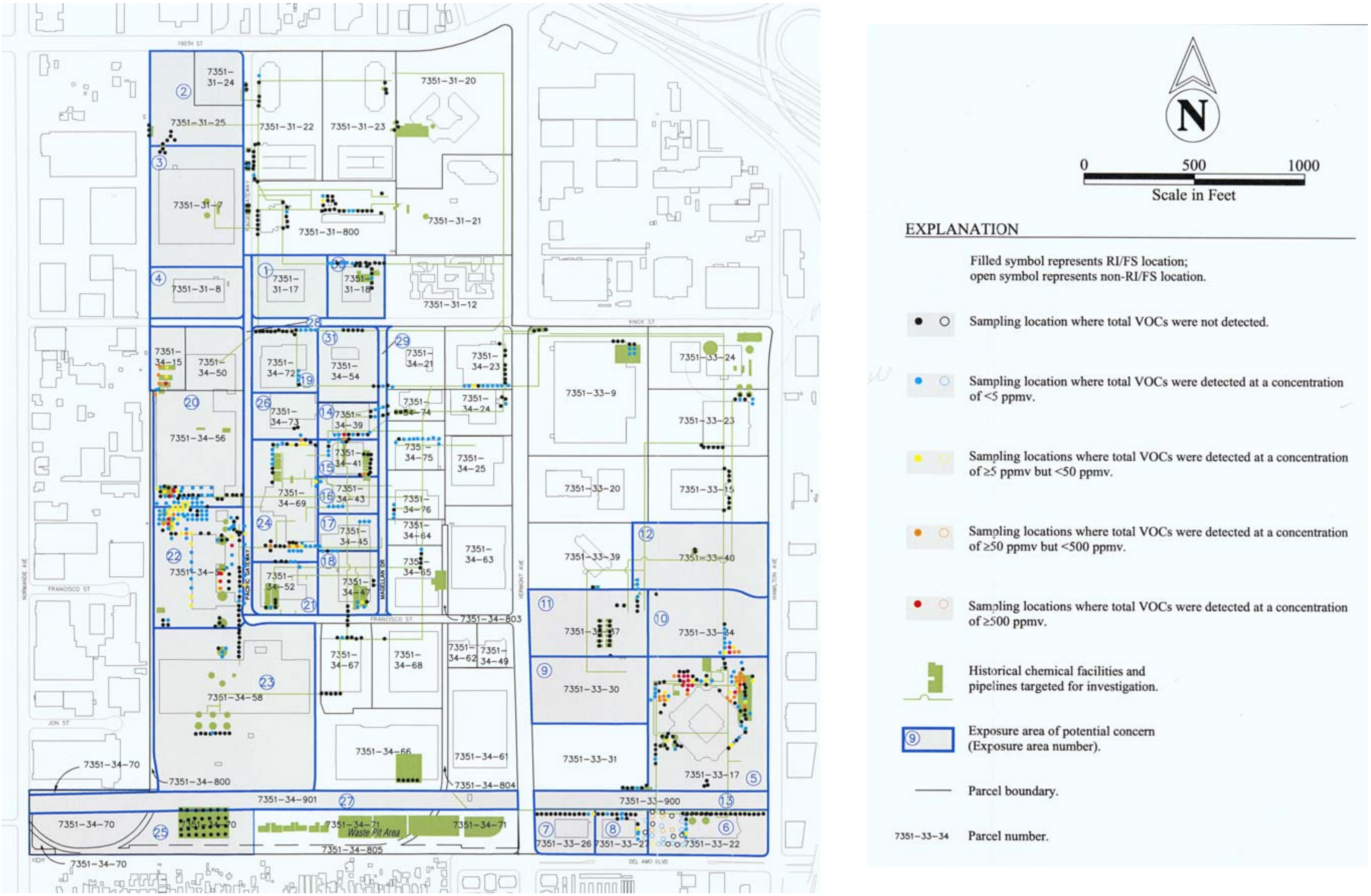


Figure 11. Buildings on the Del Amo Site Where Indoor Air Sampling Was Conducted (Data Source: Dames and Moore Feasibility Study)

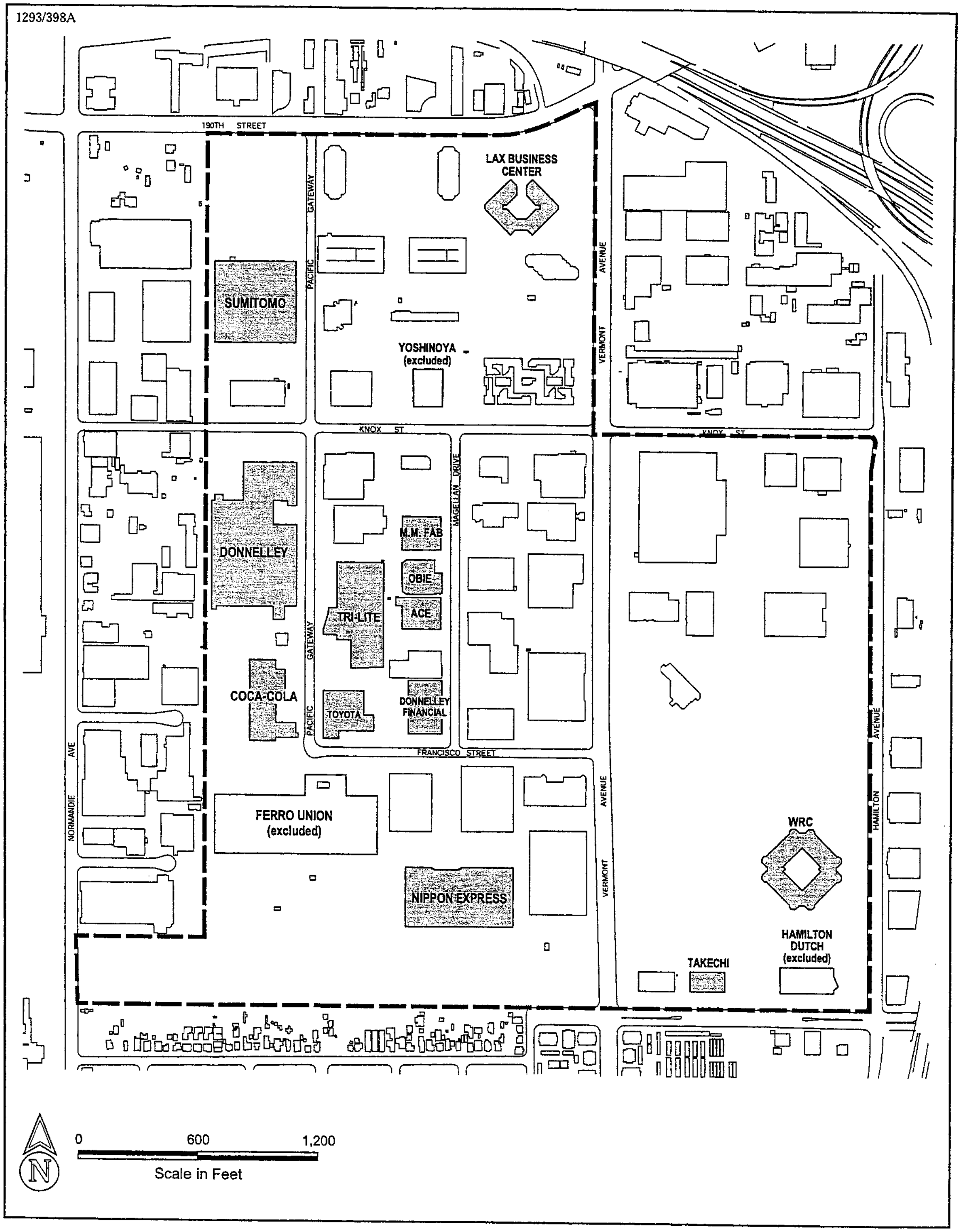
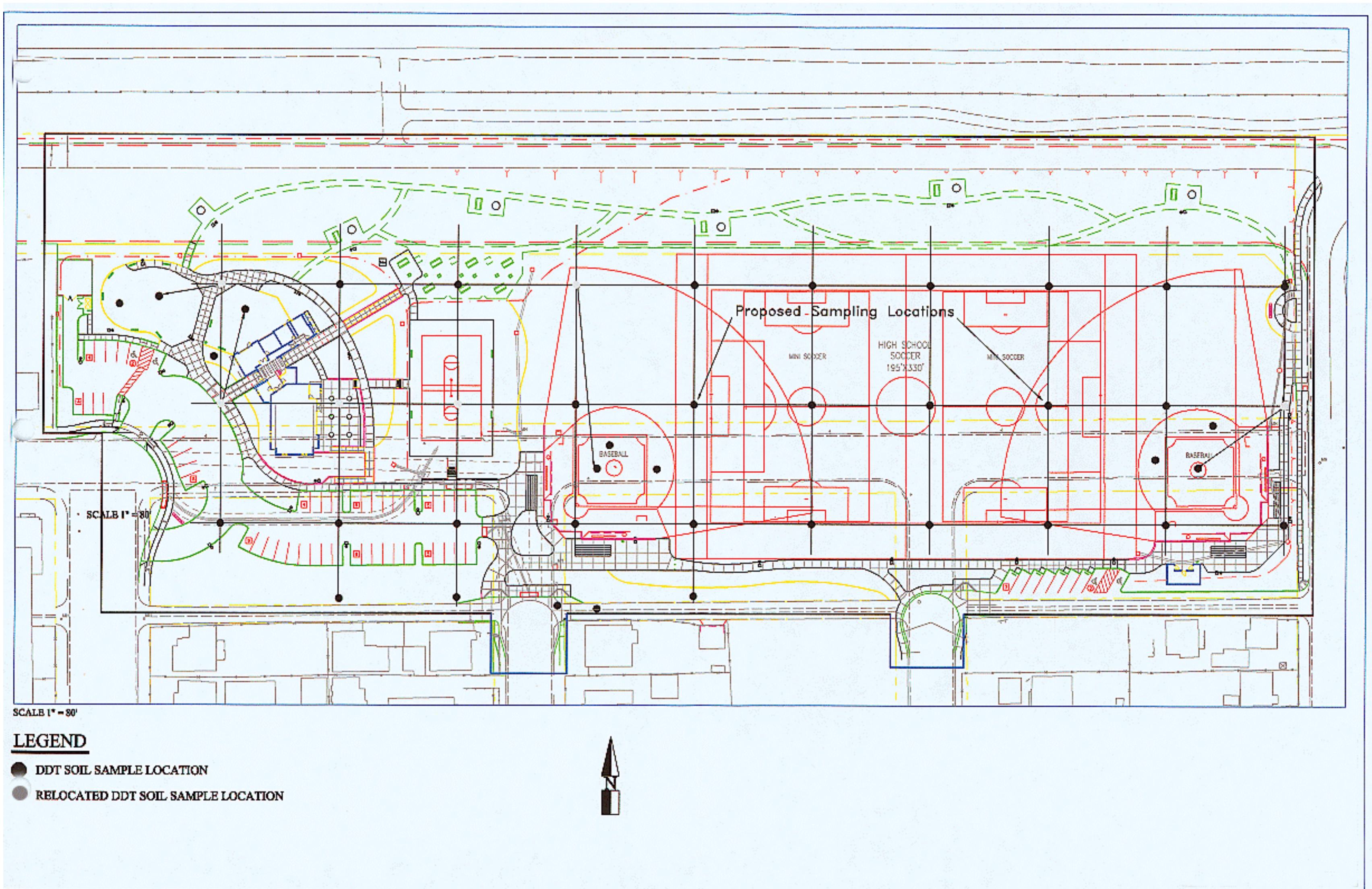


Figure 12. Future Layout of Community Park in Area South of the Del Amo

Site



Proposed Sampling Locations
MINI SOCCER
HIGH SCHOOL SOCCER 195'X330'
MINI SOCCER
BASEBALL
BASEBALL
SCALE 1" = 80'
SCALE 1" = 80'
LEGEND
DDT SOIL SAMPLE LOCATION
RELOCATED DDT SOIL SAMPLE LOCATION
N

Appendix D - Status of the Recommendations made in the Preliminary Public Health Assessment dated January 12, 1994

In the public health assessment CDHS reviews environmental and health data that was collected as of January 1, 1992 (25). The health assessment was shared in draft form with the regulatory agencies in July 1992. The Public Health Assessment was finalized on January 12, 1994. In the health assessment, CDHS made recommendations for additional data and for actions that are needed to reduce and eliminate exposure. In this appendix, we report on the status of the recommendations that were made in that health assessment..

CDHS/ATSDR Recommendations:

a. Improve current public access restrictions to the former waste disposal area through such measures as more secure gates and fences and posting of more signs in both English and Spanish.

Status: USEPA ordered Shell (who hired Dames and Moore) to inspect and repair fences on a weekly basis as part of their continuing responsibilities to monitor the site.

b. Keep the unpaved Del Amo Boulevard clear of physical hazards.

Status: EPA took no action on this item because they have no jurisdiction in this area. CDHS is not aware of who might be the responsible agency for this recommendation.

c. Evaluate the potential for soil gas migration underneath homes and businesses near the site.

Status: In August and September 1994 and January and February 1995, an environmental consulting firm, Dames and Moore (under contract with Shell Oil Company), conducted a soil gas investigation. This investigation was designed to determine if chemicals from the waste pits were migrating through the soil away from the waste pits and toward the residences located along West 204th Street. USEPA's contractor, CH_2M Hill, provided oversight during this investigation. According to the results of the investigation, the levels of chemicals detected in the soil gas do not appear to pose an ambient air problem. For more a more detailed review of the data, see Del Amo Health Consultation- Potential Health Impact Due to the Emissions from the Waste Pits (43).

d. Protect persons on and off the site during remediation from exposure to any dusts or vapors that may be released.

Status: According to the USEPA all activities at the site will be performed in a manner that is protective of human health and the environment.

e. Provide on-site remedial workers with adequate protective equipment and training, in accordance with 29 CFR 1910.120, and follow appropriate National Institute for Occupational Safety and Health and Occupational Safety and Health Administration guidelines.

Status: USEPA and the other regulatory agencies require their own employees and contractors as well as the responsible parties and their contractors to be properly trained for hazardous waste site work. Each entity is required by OSHA regulations to properly protect their workers from unacceptable exposures to hazardous substances.

f. Prevent further lateral and vertical migration of groundwater contaminants; maintain continuous monitoring of municipal wells in the area that may be potentially affected.

Status: A Record of Decision for the groundwater has been issued, implementation of the remedy is underway.

g. Implement institutional controls to prevent future use of contaminated aquifers for drinking water supplies until remediation has reduced contaminant concentrations to below levels of health concern.

Status: A Record of Decision for the groundwater has been issued, implementation of the remedy is underway.

h. Identify current users of private industrial wells in the area and determine whether water from these wells is contaminated.

Status: It is not clear if this has ever been done.

I. Implement deed and building restrictions to prevent future development on the site until contamination has been reduced to levels below health concern or until levels have been documented to exist at levels below health concern.

Status: The 1997 ROD for the waste pits selected deed restrictions as an element of the remedy, in order to prohibit residential use of the waste pits area, and to ensure any future commercial or industrial uses do not damage the remedy (a cap and a SVE). As long as the remedy is not impacted, USEPA believes that future reuse of the land can occur without negative impact to the users. The remainder of the Del Amo site is still being studied and an assessment will be performed as to any unsafe exposures of potential future unsafe exposures and appropriate remedial actions will be prescribed.

j. Collect additional groundwater data related to sources of contamination within the 280 acre site in order to supplement groundwater data available from other information sources in order to determine overall extent of groundwater contamination on and off the 280 acre site.

Status: Groundwater studies have been completed.

k. Assess the nature and extent of the floating layer in the shallow groundwater in the area of the 280-acre site through additional groundwater sampling and soil gas surveys; prevent further migration of the floating layer.

Status: According to USEPA, the main contaminant, benzene (which is a light non-aqueous phase liquid, or a smeared LNAPL), has reached the B sand aquifer. The B sand aquifer is directly below the Upper Bellflower (dry) aquifer (the “shallowest” aquifer) and above the C sand, Lower Bellflower, Gage, Lynwood, and the Silverado aquifers (the deepest aquifer). The dissolved plume has reached the Lower Bellflower aquifer. The other contaminants are ethylbenzene, naphthalene, chloroform, TCE, PCE, and para-chlorobenzosulfonic acid. The Silverado aquifer which is used for drinking water has not been impacted. Various remediation techniques were currently being investigated by USEPA. USEPA's goals are to: 1) isolate NAPL forever; 2) restore the outside groundwater to drinking water standards; 3) contain the contaminants that can not be remediated; and 3) evaluate removing the pure NAPL at a later date.

l. Conduct indoor air monitoring to assess the migration of soil gas from contaminated soil or groundwater through subsurface soil and into houses and other structures.

Status: In August and September 1994, USEPA collected indoor air samples from the properties located on West 204th Street, see the Montrose Chemical Corporation Health Consultation-Health Impact of Contamination in Soil, Air, and Tap Water for a review of this data (32). The responsible parties conducted indoor air testing in buildings located on the developed portion of the Del Amo site (4). In 1996, contractors for the responsible parties sampled the workplace air at twelve buildings in the developed portion of the site (Table 9) (4). Benzene, ethyl benzene, styrene, toluene, 1,1,1-trichloroethane, and xylenes were detected in most of the building samples at levels that are fairly typical for indoor air (41, 42). These chemicals have been found in the soil, soil gas, and groundwater on the site, thus there could be some contribution from the contamination.

m. Conduct soil gas survey during rainy and dry periods, in conjunction with additional soil and groundwater sampling for the 280 acre site in order to identify additional sources of contamination and to assess migration of soil gas from known sources, such as the waste disposal area, during rainy and dry periods.

Status: See status update for recommendation c.

n. Collect surface soil (0-3") samples from the 3.7 acre waste disposal area and other undeveloped areas of the 280 acre site, the unpaved Del Amo Boulevard, residential yards, and appropriate background locations for comparison in order to characterize adequately the extent and amount of site contamination that may exist on and off the site. If residential yard soil shows high levels of contaminants, home grown vegetables and fruits and free ranging chickens may also need to be sampled for contaminants.

Status: The responsible parties with oversight from the USEPA and DSTC capped the waste pits by installing protective layers of materials over the pits, which prevents the waste from moving to the surface. Also, in order to prevent the migration of contaminants to the underlying groundwater, the contaminated soil beneath the pits will be cleaned using a soil vapor extraction unit that will extract contaminated vapors and treat them. The mechanism by which the vapors will be treated is now being discussed with the community and other agencies.

As part of a sampling effort to characterize potential releases from the Del Amo site, USEPA collected shallow soil samples (0 - 6 inches) in October 1993 at 19 locations along W. 204th Street, between Normandie Avenue and New Hampshire Avenue (23). No chemicals associated with the Del Amo site were detected at levels of health concern; however, DDT was found in two yards located along W. 204th Street at 32 ppm and 111 ppm. Subsequent sampling by USEPA revealed an area along 204th Street, approximately six lots, that had been filled with material that included DDT. USEPA carried out a removal action for this area in April and May 1994. Soil in the two yards containing DDT at greater than USEPA's clean-up goal of 26 ppm was removed. For a more detailed review of the off-site soil sampling see the Montrose Public Health Assessment and the attached health consultations.

o. Collect surface and subsurface soil (greater than 3") data for the rest of the 280 acre site in order to assess the extent of soil contamination that may exist due to previous storage and handling operations associated with the former rubber manufacturing facilities (for instance storage tanks, pipelines, and waste sumps) or due to other present on-site sources (existing companies and businesses).

Status: Numerous soil and soil gas samples have been taken throughout the 280-acre site study area between 1993 and 1996 (4). This data was reviewed as a part of this health assessment.

p. Collect multiple background and site specific ambient air samples, with appropriate meteorological monitoring, to determine overall air quality in the area and to determine site specific air releases. Air samples to document releases from the site in an undisturbed state and a disturbed state (such as during soil borings or excavation activities) should be collected. Analyses should include information for organic and inorganic contaminant concentrations. An air model can also be used to determine dispersion of vapor releases via ambient air.

Status: Between September 30 to October 16, 1996, the SCAQMD has conducted an ambient air quality monitoring investigation in the City of Torrance. The purpose of the study was to measure the level of gaseous emissions from industrial sources in the vicinity of Del Amo Boulevard, Vermont Street, and Normandie Street, and in the vicinity of the Del Amo Waste Pit.

r. Collect data on particulate in indoor and ambient air samples. Use of an appropriate air model to determine fugitive dust emissions from contaminated soil, dispersion, and deposition may also be necessary.

Status: USEPA reports that the surface soil has not been found to contain harmful concentrations of chemicals from the Del Amo facility therefore particulate data would not be helpful.

s. Collect house dust samples to determine if they contain site-related contaminants that could have migrated from the site.

Status: A household dust sampling investigation was conducted in May 22-24, 1995, in order to obtain quantitative levels of DDT and its breakdown products, benzene hexachloride and its isomers in eighteen homes along West 204th Street (46, 47). Based on the household dust data reviewed, the levels of DDT do not appear to pose non-cancer health concerns. The cancer risk of DDT ranged from no apparent increased cancer risk to a very low increased cancer risk. The levels of and benzene hexachloride and its isomers in all the samples analyzed were non-detect (i.e., below 1 ppm). For a more detailed review see Montrose Health Consultation- Health

Impact of Contaminants in Dust II.

t. In coordination with other agencies, CDHS will provide ongoing community education in appropriate languages to the communities near the site about possible health effects from site-related contaminants and ways to prevent, cease or reduce exposures.

Status: Much of the outreach activity conducted by CDHS, USEPA, and DTSC occurred in cooperation with the community and other agencies through the Outreach and Education Task Team of the Del Amo/Montrose Partnership. Though the partnership has ended, CDHS will continue to work with community and agencies to share exposure and health information.

u. When data become available to assess exposure levels, CDHS and ATSDR will reevaluate this site for indicated follow-up health actions.

Status: Since the publication on the Del Amo Facility Health Assessment, CDHS/ATSDR has reviewed, evaluated, and interpreted additional data as they became available. For example, four Health Consultations (which provide information on the following topics: soil, tap water, indoor air, household dust, and the waste pit) have been issued. CDHS has also commented on several workplans for site characterization and remediation activities. CDHS will continue to work closely with other governmental agencies and to review additional environmental data as they become available to ensure that the health and well being of the Del Amo and Montrose communities.

Appendix E -Summary of Public Health Activities Conducted for the Del Amo and Montrose Sites (1983-2001)

CDHS/ATSDR INVESTIGATIONS OF THE DEL AMO/MONTROSE SUPERFUND SITES AND NEARBY NEIGHBORHOODS, 1983-2001

Over a period of fifteen years, the California Department of Health Services (CDHS) and the Agency for Toxic Substances and Disease Registry (ATSDR) have conducted health investigations of the Del Amo/Montrose Superfund sites and surrounding neighborhoods. This appendix is a summary of our major findings and activities, and provides a chronology of the development of our understanding of these sites. At the end of the appendix is a complete list of CDHS/ATSDR publications related to Del Amo and Montrose sites.

The United States Environmental Protection Agency (USEPA) first investigated DDT contamination related to the Montrose site in 1982 (48). ATSDR's involvement began in 1983, when it reviewed information from the Montrose site and made the following recommendations:

- Public access to contaminated areas should be restricted;
- Fishing and selling fish from contaminated waters should be restricted;
- More soil and air testing should be done;
- Cancer rates in the surrounding neighborhoods should be studied.

Several years later, ATSDR reviewed additional information on DDT-contaminated soil and dust from areas surrounding the Montrose site. In a 1988 Health Consultation on DDT in Soil and Dust, ATSDR found that neighboring residents could be exposed by eating small amounts of DDT in soil and by breathing DDT in air, and recommended that action be taken to reduce the potential for such exposure (49).

CDHS first became involved at the Del Amo/Montrose sites in 1984, the year that Montrose was first nominated for the USEPA's National Priority List (NPL) of most hazardous waste sites (also known as Superfund). In response to community health complaints, CDHS conducted an epidemiological study to examine the health status of 2500 people who were living near the sites at that time. The Del Amo-Montrose Health Effects Study (26), released in 1987 , found that:

- Residents of these neighborhoods did not experience higher rates of cancer, reproductive problems (miscarriage, stillbirth, low birth weight, and birth defects), or death;
- There were higher rates of liver disease in the area, which can be caused by exposure to organic chemicals such as DDT, a pesticide manufactured at the Montrose site. However, because liver disease was not associated with living near either site (residents with liver problems did not live closer to the waste sites than did other residents) it was not thought to be caused by the sites;
- There were increased rates of skin, eye, nose, and throat irritation as well as earaches, dizziness, and fatigue. These are symptoms often associated with airborne pollutants such as the volatile organic compounds present at the Del Amo site. Because these symptoms were greater near Del Amo, there is some evidence linking these health problems to that site. They could also have been caused by other pollution in the area.

Because residents who had moved away were not included in the study and those who did participate only lived in the neighborhood for an average of 6 years, this study could not answer questions about long-term effects. Some health effects, such as cancer, can take 15-20 years to develop; others, such as reproductive problems and reactions to irritants, may become apparent shortly after exposure. This study helps to understand these shorter-term effects.

The Montrose site was finally placed on the NPL in 1989. CDHS, now working under a cooperative agreement with ATSDR, conducted a Site Review and Update in August 1992, which was revised in August 1993 (50). This document reviewed all the information relevant to the possible public health impact of the Montrose site. Despite the protective measures USEPA had taken in response to ATSDR's 1988 recommendations, CDHS concluded that there was still potential for exposure to DDT through contact with soil, dust, and fish. CDHS recommended that a full pubic health assessment be conducted when USEPA finished its site investigations.

The Del Amo site was first proposed for the NPL in 1993. CDHS, again working under a cooperative agreement with ATSDR, began a public health investigation of this site. In February 1993, CDHS wrote and distributed a fact sheet in English and Spanish to the community called Your Health and the Del Amo Site, Findings From the Health Assessment, summarizing the major findings of the investigation (51). CDHS released the Del Amo Facility Preliminary Public Health Assessment (PHA) in January 1994 (25). The PHA:

- Reviewed three additional sources of information about cancer, reproductive problems, and deaths in the area. The conclusions were similar to the CDHS 1987 Health Effects Study. A study of cancer incidence from 1972 to 1982 found no overall increase in cancer risk in children or adults, and there was no pattern suggesting that cancers in the area were associated with the sites;
- Found that in the past, residents and workers had been exposed to volatile aromatic hydrocarbons (benzene and ethylbenzene) from Del Amo by breathing the air, and may have been exposed to polycyclic aromatic hydrocarbons (naphthalene, benzopyrene, phenanthrene, and chrysene) through skin contact and by eating small amounts in soil;
- Concluded there was not enough information to know what or how much people may have been exposed to, or if current or future exposures were possible;
- Recommended further testing of outdoor and indoor air, house dust, groundwater, soil gas, and surface soil on the site and in the surrounding neighborhood.

As a result of these recommendations, by September 1993 USEPA had sampled surface soil at residential properties on 204th Street, bordering the Del Amo site. Unexpectedly, instead of finding contamination associated with Del Amo, they found DDT, a contaminant from the nearby Montrose site. It was soon discovered that DDT from the Montrose site had been used in fill material during development of the neighborhood. In a 1993 Health Consultation, Residential Backyard Soil Sample Review, CDHS found that DDT was present at levels of health concern in several yards and recommended additional sampling (23). In March 1994, CDHS wrote and distributed a fact sheet in English and Spanish called DDT In Your Environment, informing residents about ways that people may be exposed to DDT and possible health effects (52).

In April and May 1994, USEPA removed some of the contaminated fill, during which the affected residents were temporarily relocated. During July, August and September 1994, USEPA tested sub-surface soil, indoor air, tap water, and house dust in and around the affected homes for contaminants from both sites. CDHS reviewed the USEPA findings in three separate Health Consultations (Montrose Chemical Corporation Soil, Air and Tap Water, 5/95; Dust 5/95; and House Dust 12/95(46, #41, #42) and concluded that:

- In four out of 28 yards tested, DDT was found in soil at levels of health concern; in two of these yards, benzopyrene was also at a level of health concern. These contaminants were found too deep beneath the ground to be considered actual health risks;
- Tap water did not appear to be contaminated;
- Indoor air in two of the 25 homes tested had higher than normal levels of benzene. Long-term exposure to high levels of benzene can cause leukemia. In this case, there were very low to low increased cancer risks depending on length of exposure (whether 9 or 30 years). Benzene in indoor air can come from many possible sources, and it is impossible to know whether or not this was related to the Del Amo site; (Note: USEPA later discovered that the source of benzene in the home with highest levels was due to a malfunctioning stove).
- Indoor air in a third home had levels of tetrachloroethylene that could cause very low cancer risks if a person were exposed for 30 years. Although this is a contaminant present at Del Amo, its source in this home was not known;
- A sampling of dust in 20 homes found low levels of DDT present in 7 homes on or near the fill area. Exposure to these levels would not be expected to cause non-cancer health problems. People exposed to the higher levels found (5ppm to 8ppm), would have very low to low risks of developing cancer, depending on how long they were exposed (whether 9 or 30 years). At the highest level found (8ppm) 30 years of exposure would result in a 1 in 92,000 increased risk of cancer in addition to the cancer risk from all other causes. This is considered to be a low increased risk;
- Many contaminants were detected about which not enough is known to be able to estimate risk.

Although CDHS did not recommend permanent relocation of residents on the basis of these findings, heightened community fears led to a buy-out and the relocation of over 60 families. The houses were torn down, the soil was cleaned or covered, and a park is being developed on the site of the former residences.

USEPA planned to dispose of the DDT contaminated fill by sending it to an incineration facility in Port Arthur, Texas. Because of the potential for incinerators to produce dioxin, members of the Del Amo/Montrose community were concerned that their toxic waste problems might be transferred to Port Arthur. In August 1998, ATSDR issued a Health Consultation on Incineration of DDT Contaminated Fill from Montrose Chemical Corporation and Del Amo (53). After reviewing information on the incinerator, stack emissions, and potential for exposure, ATSDR concluded that the Montrose fill material could be incinerated without posing a public health concern for residents of Port Arthur.

By now, attention had turned to potential DDT contamination in the neighborhood, but many residents were still concerned about air emissions from the Del Amo waste pits. In a Health Consultation on the Del Amo Facility: Potential Health Impact Due to Emissions From the Waste Pits released in November 1996, CDHS:

- Reviewed environmental testing of air on the surface of the waste pits, and of outdoor air and soil gas at the former waste disposal area and in the backyards of homes. This was done to find out whether chemicals were being released into the air at levels that could be harmful to the health of nearby residents;

- Found that the levels of chemicals in the soil gas were not high enough to cause a problem in indoor air;
- Concluded that the low levels of volatile and semi-volatile organic compounds (VOCs and SVOCs) and hydrogen sulfide in outdoor air were not high enough to cause non-cancer health problems. One contaminant with elevated levels, tetrachloroethene, is carcinogenic. The estimated cancer risk from inhaling this chemical over a period of 30 years was considered to be very low;
- Found that there were eight chemicals about which not enough is known to be able to estimate risk.

One result of the 1993 discovery of DDT in the neighborhood was that ATSDR funded a three-year community health investigation by the University of California at Irvine. The Del Amo/Montrose Environmental Health Program was established to study the health problems of residents and to address their health concerns. Among other things, clinic physicians wanted to know what breast-feeding advice to give women whose blood had been tested for DDT. In February 1997, CDHS released a Health Consultation on Infant Health Implications of Breast-feeding When Considering Maternal DDT Levels (54). This report:

- Reviewed the limited number of studies on the developmental effects of DDT and the relationship between DDT in the blood and in breast milk;
- Used these studies to develop guidelines advising whether or not to breast-fed, weighing the unknown potential harm from DDT against the known benefits of breast-feeding;
- Recommended that at 21parts per billion (ppb) or greater of serum DDT, the mother should receive;
- counseling focused on the limited knowledge about the harmful effects of DDT in breast milk and the proven benefit that breast-feeding provides the child;
- Recommended that at 150ppb of serum DDT, women should be advised not to breast-feed.

Another milestone was the formation of the Del Amo/Montrose Partnership in February 1997. Through the Partnership, members of the community, staff of the various government agencies involved at the site, political representatives, and other stakeholders hoped to develop a better understanding of issues and a coordinated approach to activities related to these sites.

In December 1999, the Del Amo/Montrose Community Environmental Health Program Final Report was released by the Center for Occupational and Environmental Health, University of California, Irvine (55). The report is a summary of the program which offered a range of environmental health services to the community, seeing 596 residents over a two-year period. From the beginning, the lack of environmental monitoring in the area at the time made it difficult to know what the environmental exposures had been. Blood tests for DDT/DDE were offered because these measurements are an indication of how much DDT/DDE a person has been exposed to from all sources. Valid blood tests were obtained from 569 people. Participants were not tested for other site-related pollutants because there are no feasible tests that could measure past exposure to these chemicals. The final report contains a detailed description of the program's services, the population served, and the clinical findings.

Although the clinic program was not intended to be an epidemiological study, the clinical data was studied to see if there were any patterns suggesting that symptoms, diagnoses, or DDT levels might be associated with certain environmental exposures. There were no significant associations found between health outcomes, DDT levels, and known exposures to DDT in the neighborhood.

In 1997, CDHS wrote and distributed a fact sheet in English and Spanish called Your Health and the Montrose Site, informing residents about ways they may be exposed to DDT and how to prevent exposure (56). In March 1997, CDHS released a Montrose Chemical Corporation PHA (57), which included all of the findings related to the Montrose site up to that time, focusing on possible exposure pathways for contaminants at the site. In addition to findings that have already been mentioned, the PHA concluded that:

- DDT is the only site-related chemical to which community members may have been exposed at levels of health concern. DDT was carried off the site in the air, through surface water runoff, and in contaminated fill that was placed in a low-lying "hot spot" area. Additional sampling in the neighborhood was recommended to see if there were other areas with high concentrations of DDT;
- Residents may have been exposed to DDT in the past. It does not appear that such exposures would result in non-cancer health effects, and potential increased lifetime cancer rates would be expected to be very low, if any;
- People may currently be exposed to DDT by breathing, eating, or touching contaminated soil, and by eating contaminated fruits, vegetables, chickens, eggs, or fish. Fruits and vegetables from the most contaminated area that were tested did not pose a health risk. Although chickens and chicken eggs from this area did contain DDT close to the FDA action levels, the exposures did not pose a health risk;
- DDT from Montrose caused substantial contamination of sediments, fish, and shellfish in the area around Palos Verdes, Long Beach Harbor and Los Angeles Harbor. Fish advisories describe which kinds of fish should be eaten in limited amounts. White Croaker from the above areas should not be eaten at all;
- There has been no exposure through drinking water, but steps must be taken to prevent future contamination of drinking water wells.

Investigators from the clinic requested more environmental testing from ATSDR to help them interpret the DDT blood test results of clinic participants. In July 1998, ATSDR released an Exposure Investigation (58). In this study:

- Thirty-three residents whose blood DDT levels were above 21ppb agreed to have their yards, homes, and chicken eggs tested for DDT. This was done to see if DDT in their blood could be due to contamination in their homes or yards;
- ATSDR tested surface soil, indoor dust, surface wipe samples, and two chicken egg samples for DDT. Chickens were raised at only one of the participating households;
- The levels of DDT found in one yard were higher than the USEPA removal action level for the site and could pose a health risk to children. The DDT levels in all the other yards

and homes tested were not at levels that caused concern;

- The DDT levels found in both eggs were considered to pose a public health hazard if eaten on a regular basis;
- ATSDR recommended an expanded exposure investigation of home-raised chicken eggs in the neighborhood, as well as further soil sampling.

In May 1999, ATSDR released a second Exposure Investigation of home-raised chicken eggs (59). In this study:

- Thirty-two eggs and 11 soil samples were collected from 10 households in the Del Amo neighborhood. No households that raised chickens could be found in the Montrose neighborhood.
- All eggs tested contained some DDT. Five eggs collected from two households had DDT levels higher than the allowable level set by the FDA.
- Soil was found to be a significant source of DDT for chickens raised in the Del Amo area. Eggs from free-range chickens that peck the soil were compared to those from chickens kept in raised pens. The eggs with higher DDT levels all came from chickens that peck soil.
- Residents who regularly consume eggs from chickens raised on the ground in the Del Amo area may have very low increased cancer risks. Those who had eggs above the FDA action level were advised not to eat the eggs. Education was provided about safer chicken-raising practices and a medical evaluation at the clinic was offered.

In June 2000, CDHS wrote and distributed a fact sheet in English and Spanish called DDT and Chicken Eggs in the Del Amo/Montrose Neighborhood (60). It provides information about exposure to DDT from home-raised chickens, possible health effects, and how to reduce exposure through safer chicken-raising practices.

In the fall of 1999, USEPA began further investigation into the off-site contamination from the Montrose site, to be completed in several phases. In June, 1999 ATSDR released a Health Consultation Contingency Plan for the Del Amo/Montrose EPA Neighborhood Soil Sampling Event (61). This document outlined what the immediate response would be to protect public health if elevated levels of DDT were found in surface soil of residences in the neighborhood during Phase I sampling. It listed three levels of DDT and recommended actions that should be taken at each level. In July, 1999 CDHS released a Health Consultation, Review of the Sampling and Analysis Plan for the Neighborhood Sampling Program, which reviewed and commented on the USEPA Phase I sampling plan (62).

The ATSDR contingency plan was modified by USEPA for Phase II Sampling. In August 2000, CDHS produced a Health Consultation, Review of the Addendum to the Site-Specific Work Plan, Sampling and Analysis Plan, and Field Sampling Plan for the Phase II of the Del Amo and Montrose Neighborhood Sampling (63). This document contains CDHS' comments on the Phase II sampling plan. It also summarizes the findings of the 1999 Phase I sampling, in which USEPA collected hundreds of soil samples and 40 fruit and vegetable samples and tested them for DDT and other chemicals. The findings were classified as follows:

- Investigation to find whether DDT in air settled to the ground and contaminated the soil.

Surface soil from the Del Amo/Montrose neighborhood was compared to soil in six background areas in other neighborhoods. The levels in the background areas had slightly lower levels of DDT on average, but were very similar to most levels found in Del Amo/Montrose. No further sampling of this kind was planned.

- Investigation of storm water runoff that flowed through neighborhood areas. Higher than normal levels of DDT were found along Kenwood Avenue in an area where there had been an unlined ditch. The yard of one house had levels of DDT that were a health concern, and USEPA placed a temporary cover over the soils in that yard. Kenwood Avenue became the focus of sampling in Phase II.
- Investigation of possible fill areas. This sampling found no evidence of fill material in low-lying areas. Areas that had slightly higher than average levels of DDT were to be studied further in Phase II.
- Investigation of homegrown fruits and vegetables. No DDT was found in any produce grown in the neighborhood, but samples did not include root crops. There were plans to sample root crops in Phase II.

ATSDR/CDHS Del Amo/Montrose Publications:

- ATSDR Health Consultation, Review of Montrose Site-Related Data 3/83
- CDHS Del Amo-Montrose Health Effects Study 12/87
- ATSDR Health Consultation on DDT in Soil and Dust 1/4/88
- CDHS Fact Sheet "Your Health and the Del Amo Site, Findings From the Health Assessment" (English and Spanish) 2/93
- CDHS/ATSDR Montrose Site Review and Update 8/93
- CDHS/ATSDR Health Consultation, Residential Backyard Soil Sample Review 11/10/93
- CDHS/ATSDR Del Amo Facility Preliminary Public Health Assessment 1/12/94
- CDHS Fact Sheet "DDT In Your Environment" (English and Spanish) 3/94
- CDHS/ATSDR Health Consultation, Health Impact of Contaminants in Dust , Del Amo/Montrose 5/95
- CDHS/ATSDR Health Consultation, Health Impact of Contaminants in Soil, Air, and Tap Water, Del Amo/Montrose 5/95
- CDHS/ATSDR Health Consultation, House Dust, Montrose Chemical Corporation 12/95
- CDHS/ATSDR Health Consultation, Del Amo Facility, Potential Health Impact Due the Emissions From the Waste Pits 11/20/96
- CDHS/ATSDR Health Consultation, Infant Health Implications of Breast-feeding When Considering Maternal Serum DDT Levels, Montrose Chemical Corporation 2/20/97
- CDHS Fact Sheet, "Your Health and the Montrose Site" (English and Spanish) Date?
- CDHS/ATSDR Montrose Chemical Corporation Public Health Assessment 3/13/97
- ATSDR Exposure Investigation Del Amo (DDT in soil, dust, chicken eggs) 7/31/98

- ATSDR Health Consultation, Incineration of DDT Contaminated Fill from Montrose Chemical and Del Amo at the Chemical Waste Management Inc. Landfill, Port Arthur, Texas 8/21/98
- Exposure Investigation Del Amo Facility (DDT in chicken eggs) ATSDR 5/27/99
- ATSDR Health Consultation. Contingency Plan for Del Amo/Montrose EPA Neighborhood Soil Sampling Event 6/24/99
- CDHS/ATSDR Health Consultation, Review of the Sampling and Analysis Plan for the Neighborhood Sampling Program, Montrose 7/6/99
- CDHS Fact Sheet "DDT and Chicken Eggs in the Del Amo/Montrose Neighborhood" (English and Spanish) 6/00
- CDHS/ATSDR Health Consultation, Review of the Addendum to Site-Specific Work Plan, Sampling and Analysis Plan, and Field Sampling Plan for Phase II of DA/M Neighborhood Sampling, Montrose, 8/9/00

ATSDR-funded Project Publications:

- D. Baker, H. Yang. The Del Amo/Montrose Community Environmental Health Program Final Report. Center for Occupational and Environmental Health, University of California at Irvine. December 1999.

Appendix F - Brief Summaries about the Chemicals of Concern

Arsenic (64)

- Naturally occurring element that is commonly found in surface soil and surface water
- Long-term exposures of lower levels of arsenic through drinking water (170-800 ppb) can lead to a condition known as “blackfoot disease”;
- Other effects include gastrointestinal irritation, and contact with skin can cause discoloration (hypo-or hyper-pigmentation), wart-like growths and skin cancer;
- The USEPA has classified arsenic as a “known human carcinogen” due to its ability to cause skin cancer, with oral exposures increasing the risks of liver, bladder and lung cancer;
- Acute oral MRL = 0.005 mg/kg/day (gastrointestinal effects in humans);
- Chronic oral; MRL = 0.0003 mg/kg/day (dermal effects in humans);
- Oral reference dose = 0.0003 mg arsenic/kg/day (dermal effects in humans.

Benzene (38)

- Naturally occurring chemical, also in top 20 (by volume) of chemicals produced in the U.S.;
- Used in a very wide range of products and industrial processes;
- Found in environment as a result of both human and natural processes;
- Degrades relatively quickly in air, slowly in soil and water;
- Does not bioaccumulate;
- Enters body through inhalation, ingestion, and dermal absorption;
- Adverse health effects due to intermediate or chronic exposures include disruption of blood production and possible reproductive problems in women;
- Intermediate inhalation MRL = 0.004 ppm (0.013 mg/m^3) (neurological effects in mice);
- Known human carcinogen;
- Oral slope factor = 2.9 x 10^{-2} (mg/kg/day)$^{-1}$;
- Inhalation unit risk = 2.9 x 10^{-5} (µg/m^3)$^{-1}$

Cadmium (65)

- Naturally-occurring element (metal), also occurs as a result of industrial processes;
- Not usually found as a pure metal, but as a mineral combined with other elements such as oxygen (cadmium oxide), chlorine (cadmium chloride), or sulfur (cadmium sulfate, cadmium sulfide);
- Enters the body primarily through inhalation and ingestion;
- People are exposed to cadmium mostly from food and cigarette smoke;
- Inhalation of high levels of cadmium can severely damage the lungs and cause death;

- Chronic exposure (inhalation) to low levels can cause kidney (renal) damage;
- Chrnic oral MRL = 0.0002 mg/kg/day (kidney damage in humans);
- Chronic REL = 0.02 $\mu g/m^3$(respiratory and kidney effects seen in occupationally exposed humans);
- Inhalation unit risk = 4.2 x 10^{-3} $(\mu g/m^3)^{-1}$;
- U.S. Department of Health and Human Services (DHHS) has determined that cadmium and cadmium compounds may reasonably be anticipated to be carcinogenic.

Chlorobenzene (66)

- Naturally occurring chemical, also synthetically produced
- Used as a solvent and in production of other chemicals
- Breaks down very quickly in water, relatively quickly in air, slowly in soil
- Can enter body through inhalation, ingestion, dermal absorption
- Adverse health effects due to acute exposure include headaches, numbness, sleepiness, nausea, vomiting, and depression of nervous system function
- Intermediate oral MRL = 0.4 mg/kg/day (liver effects in rats)
- Oral reference dose = 0.02 mg/kg/day (liver effects in dogs)
- Not classifiable as to human carcinogenicity.

Dichlorodiphenyltrichloroethane (DDT) (67)

- Widely used pesticide in the U.S. for insects on agricultural crops from the 1940s until it was banned in 1972
- Still used around the world to combat malaria and typhus;
- DDT and its breakdown products DDE and DDD last for a long time in the soil (greater than 30 years in some types of soil);
- Does not occur naturally in the environment;
- Based on prior use and the fact that it lasts so long in the soil, DDT and its breakdown products are found in most soils even in the Arctic and Antarctic even if they were not used there, ie there are background levels of DDT in most soils;
- Mainly gets into the the body through the food we eat;
- Also can get into the body from inhaling when it is in the air or ingesting particles of soil to which the DDT is adhered;
- Animal studies show that long-term exposure can affect the liver; short-term exposure can affect reproduction; and DDT breakdown products can affect the adrenal gland;
- Acute oral MRL = 0.0005 mg/kg/day based on neurodevelopmental effects in mice seen at

0.5 mg/kg/day;

- Intermediate MRL = 0.0005 mg/kg/day based on liver effects in rats;
- Studies in animals have shown that oral exposure to DDT can cause liver cancer;
- Studies of DDT-exposed workers did not show increases in deaths or cancers;
- The U.S. Department of Health and Human Services has determined that DDT may reasonably be anticipated to be a human carcinogen;
- The International Agency for Research on Cancer (IARC) has determined that DDT may possibly caused cancer in humans;
- The USEPA has determined that DDT, DDE and DDD are probable human carcinogens.

Ethylbenzene (68)

- Naturally occurring chemical, used in many products;
- Evaporates easily, does not dissolve readily in water;
- Breaks down in air after a few days in presence smog and sunlight;
- Can be broken down in soil, can migrate down to groundwater;
- Can enter body through inhalation, ingestion, dermal absorption;
- Adverse health effects in animals due to chronic exposure include the possibility of cancer;
- Intermediate inhalation MRL = 0.2 ppm (0.8 mg/m^3) (developmental effects in rats);
- Chronic oral reference dose = 0.1 mg/kg/day (liver and kidney effects in rats;
- Reference concentration = 1 mg/m^3 (developmental effects in rats and rabbits);
- Not classifiable as to human carcinogenicity.

Polychlorinated Biphenyls (PCBs) (69)

- Produced in the U.S. between 1933-1977 for use as coolants and lubricants;
- Mixtures of up to 209 individual chlorinated compounds (known as congeners);
- Though no longer manufactured, PCBs are still released during some industrial processes, from hazardous waste sites; illegal or improper disposal of industrial wastes, consumer products; leaks from old electrical transformers containing PCBs; and burning of some wastes in incinerators;
- Food most common source of PCB uptake in the general population;
- Bioaccumulate in food chains and are stored in fatty tissues;
- Do not readily break down in the environment and thus may remain there for very long periods of time.
- Most common health effect observed from exposure to PCBs are skin rashes and acne;

- Reproductive effects have been shown in women exposed to high levels of PCBs in the work place or from eating contaminated fish;
- High levels of PCBs may cause liver damage;
- Limited human (workers) and animal studies have shown an association with liver and biliary cancer;
- Possible human carcinogen;
- Intermediate MRL for Aroclor 1254 = 0.00003 mg/kg/day (developmental effects);
- Chronic MRL for Aroclor 1254 = 0.00002 mg/kg/day (immunological effects);
- Oral reference dose fro Aroclor 1016 = 0.00007 mg/kg/day.

Polycyclic Aromatic Hydrocarbons (PAHs) (70)

- Group of chemicals (more than 100) formed during the incomplete burning of oil, coal wood, gas, garbage, or other organic substances like tobacco or charbroiled meat;
- Present throughout the environment and occur generally as mixtures, not individually;
- People may be exposed from environmental sources such as air, water, and soil and from cigarette smoke and cooked food;
- Seventeen PAHs focused on in the literature based on available information, greater chance for exposure, and potentially the most harmful (acenaphthene, acenaphthylene, anthracene, benzo[a]pyrene, benzo[e]pyrene, chrysene, benz[a]anthracene, benzo[j]fluoranthene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[g,h,i]perylene, fluorene, fluoranthene, indenol[1,2,3-c,d]pyrene, phenanthrene, pyrene, and dibenz[a,h]anthracene);
- Animal studies have shown that PAHs can cause harmful effects on the skin, body fluids, and ability to fight disease after both short and long-term exposure. But these effects have not been seen in people;
- Some PAHs have caused cancer in laboratory animals when they breathed air containing them (lung cancer), ingested them in food (stomach cancer), or had them applied to their skin (skin cancer);
- PAH mixtures containing benzo[a]pyrene, chrysene, benz[a]anthracene, benzo[a]fluoranthene, and dibenz[a,h]anthracene may reasonably be expected to be carcinogens;
- ATSDR intermediate oral MRL for anthracene = 10 mg/kg/day;
- USEPA chronic oral reference dose for anthracene = 0.3 mg/kg/day;
- OEHHA potency equivalent factors (PEF): benzo[a]pyrene index compound;
- OEHHA oral slope factor for benzo[a]pyrene = 1.2 $(mg/kg/day)^{-1}$;
- OEHHA inhalation unit risk for benzo[a]pyrene = 1.1×10^{-3} $(\mu g/m^3)^{-1}$;
- OEHHA inhalation unit risk for benzo[b]fluorthrene;
- OEHHA inhalation unit risk for benzo[b]fluoranthrene = 1.1×10^{-4} $(\mu g/m^3)^{-1}$;

- OEHHA inhalation unit risk for dibenz[a,h]anthracene = 1.2×10^{-3} ($\mu g/m^3$)

Styrene (71)

- Synthetic chemical
- Most commonly used in manufacture of various types of rubbers and plastics
- Liquid at normal temperatures, evaporates easily
- Breaks down relatively quickly
- Can enter body through inhalation, ingestion, dermal absorption
- Chronic inhalation MRL = 0.06 ppm (0.26 mg/m^3) (neurological effects)
- Intermediate oral MRL = 0.2 mg/kg/day (liver effects)
- Chronic oral reference dose = 0.2 mg/kg/day (hematological, liver effects in dogs)
- Inhalation reference concentration = 16 mg/m^3 (CNS (central nervous system) effects in humans)
- Probable human carcinogen.
- Oral slope factor = 0.03 $(mg/kg/day)^{-1}$

Tetrachloroethylene (72)

- Synthetic chemical used as a dry cleaning fluid, a degreaser, and as a starting material for other products;
- Evaporates quickly, but breaks down very slowly;
- Can travel easily through soils to reach groundwater;
- Inhalation most common way to enter body, also ingestion if drinking water is contaminated;
- Adverse health effects due to chronic inhalation exposure possibly include reproductive effects in women;
- High levels of exposure in animals may cause liver, kidney damage;
- Chronic inhalation MRL = 0.04 ppm (0.27 mg/m^3) (neurological effects in humans);
- Oral reference dose = 0.01 mg/kg/day (liver effects in mice);
- Oral slope factor = 0.051 $(mg/kg/day)^{-1}$;
- Inhalation unit risk = 5.9×10^{-6} $(\mu g/m^3)^{-1}$.

Toluene (73)

- Naturally occurring chemical, also occurs as a result of industrial processes
- Widely used solvent in many industrial processes and products

- Enters body through ingestion, inhalation, and dermal absorption
- Adverse health effects due to intermediate and chronic exposures include tiredness, confusion, weakness, drunken-type actions, memory loss, nausea, and loss of appetite
- Chronic inhalation MRL = 0.08 ppm (0.30 mg/m^3) (neurological effects in humans)
- Intermediate oral MRL = 0.02 mg/kg/day (neurological effects in mice)
- Oral reference dose = 0.2 mg/kg/day (increased organ weight in rats)
- Inhalation reference concentration = 0.4 mg/m^3 (neurological effects in humans)
- Not classifiable as to human carcinogenicity

Trichloroethylene (74)

- Synthetic chemical, liquid at room temperature;
- Most commonly used as a degreaser, also used in some household products;
- Evaporates readily from surface soil, water;
- Breaks down in air to form phosgene, which is a lung irritant;
- Breaks down more slowly from deep soils, groundwater;
- Can enter body through inhalation, ingestion, dermal absorption;
- Adverse health effects due to chronic exposure possibly include childhood leukemia, heart defects, other birth defects;
- Acute inhalation MRL = 2 ppm (10.7 mg/m^3) (neurological effects in humans);
- Intermediate inhalation MRL = 0.10 ppm (0.54 mg/m^3) (neurological effects in rats);
- Acute oral MRL = 0.2 mg/kg/day (developmental effects in mice);
- Possible-Probable Human Carcinogen;
- Oral slope factor = 0.015 (mg/kg/day)$^{-1}$;
- Inhalation unit risk = 2 x 10^{-6} (µg/m^3)$^{-1}$.

Xylenes (75)

- Naturally occurring chemical, also synthetically produced, used as a cleaning agent, solvent, paint thinner, and in other products;
- Evaporates easily, does not dissolve easily in water;
- Breaks down slowly in soil or groundwater, breaks down relatively quickly in sunlight in air;
- Can enter body most commonly through inhalation, also ingestion and dermal absorption;
- Chronic inhalation MRL = 0.1 ppm (4.34 mg/m^3) (neurological effects in humans);
- Intermediate oral MRL = 0.2 mg/kg/day (blood effects in rats);

- Oral reference dose = 2 mg/kg/day (hyperactivity, decreased body weight, increased mortality in rats);
- Not classifiable as to human carcinogenicity.